

EDITORIAL
LIBRARY

The 1999 Shareware Awards



The Best New Downloads: ● E-Mail
● Internet Tools ● Games ● and More

Sights and Sounds

Cool Players and
Cool Sites for Web
Tunes and Video

Fast Connections

Internet Caching
Speeds Access to
The Online World

FIRST LOOKS:

- 650-MHz IBM Aptiva
- Instant Messengers:
AOL vs. Microsoft
- Adobe Photoshop 5.5
- Creative Nomad
- Princeton & ViewSonic
Digital LCD Panels
- Ultraportable,
5-Pound Projectors



MAGAZINE

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THE INDEPENDENT GUIDE TO PERSONAL COMPUTING AND THE INTERNET

VOL.18 NO.16 SEPTEMBER 21, 1999

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What Good Is a Faster Chip?

Recently, a number of friends have asked me a question that I thought was silly: "What good is a faster chip?" A few years ago, the answer was easy: You need a faster chip to take advantage of a new operating system and new applications. Windows 95 and Office 95 were huge steps forward from their predecessors

and ran much better on faster systems than on the 486s that were prevalent at the time.

But as systems and the processors on which systems are based have gotten faster over the past few years, the applications haven't been sapping the processing power the way they used to. Yes, today's applications require more horsepower and more disk space than the programs of four years ago, but the hardware has more than kept up. Pretty much any Pentium II, K6, or Celeron system can handle Windows 98 or NT, Office 2000, or any other office productivity application you can throw at it. The old saying "Intel giveth, Microsoft taketh away" may still have a ring of truth, but it isn't as pronounced as it used to be.

Besides, a lot of what all of us do with our machines these days involves the Internet, and those things are more dependent on the speed of the connection than on the speed of the processor.

So what good are the new processors? Despite Intel's claims to the contrary, it isn't that new processors will somehow make Web sites download faster or look better. PC Labs has found almost no difference in either the speed or the quality of the Internet experience with a Pentium III/450 compared with a Pentium II/450, even on sites specifically designed to work with the Pentium III's new features. (For more information, see our cover story on page 100 and Inside PC Labs on page 29.) That may change sometime in the future, but for now, the new Intel processor does not mean faster Web access.

Instead, the biggest benefit is for people who create or work with digital content. If you've ever edited a digital photo in Adobe Photoshop (or even Adobe PhotoDeluxe or Microsoft Picture It!), you know that the process could be faster. Even if you're doing something as simple as recording your CDs for use in a PC jukebox, you know that systems could be faster. Have you tried to edit digital video? No system on the planet is fast enough. Combine images,

videos, maybe music, and lots of content to create a great Web site or presentation and suddenly almost every system seems more sluggish than you'd like.

None of these applications are fast enough or easy enough to use, and they don't do everything you want, in large part because the systems aren't fast enough.

We expect to see a lot of other applications become more mainstream—those that require much more processing power than anything on the market. Speech recognition has made great strides in the past several years, but there still isn't a program that accurately transcribes normal talking. We've seen some small steps with automated "bots" and agents

that find things you're interested in, but there is nothing comparable to the applications we'll want in the future.

In the meantime, the biggest use of processing power isn't for any one particular application but for multitasking. We used to talk about multitasking in the abstract, but most of us mostly did task switching—keeping multiple applications open but working on only one.

Look at what's running on your system. If you're like most users, you keep an e-mail program and a Web browser open. Perhaps you run an instant messaging program as well. You probably should be running a virus checker. In a large organization, you probably have some sort of network management agent running in the background checking the status of your system. Maybe you're playing music in the background, or you have a TV window or stock ticker running. Oh, yes, and you still have your primary application open—most likely a word processor, spreadsheet, or database program.

If you're like me, usually everything works smoothly, but every once in a while, things seem to slow down. Often this means that one background program or another suddenly needs extra processing power. And today, that's why many of us still want faster processors. **PC**

The answer lies in a long-forgotten purpose of new operating systems: multitasking.



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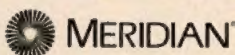
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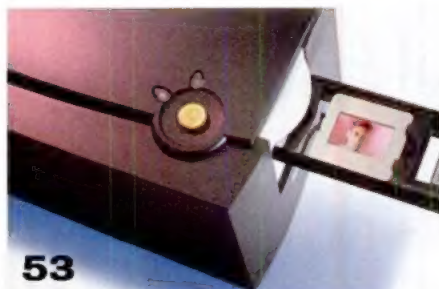
PC Mall

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Photography: Mert Kerim (bottom), Thom
O'Connor (top); illustration: Jean Tuttle

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Download A/V Test Files

In this issue, we tested all the tools that
bring audio and video content to your Web
surfing. How did we do it? Download the test
files we used and try them out.

Shareware Winners

Read about the winners of the 6th Annual
Shareware Awards; then visit us online to
download your favorites from our site.

New-Product Alerts

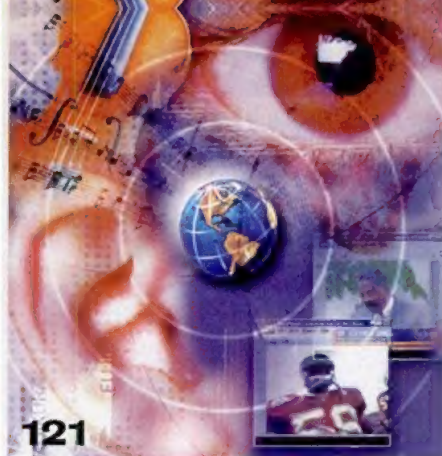
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COVER STORY: PROCESSORS

100 The Right Speed for You

Is Intel's Pentium III worth the price, or will a Celeron or AMD K6 do the job? Is Athlon the hot ticket AMD wants you to think it will be? To help you decide on the right CPU, we test them all. *By Michael Slater*

WEB AUDIO AND VIDEO

121 Surf, Look, and Listen

The revolution will not be televised; it will be Webcast. We show you the best formats for digital music and streaming audio and video, the best sites to find them, and more. *By Jan Ozer*

CACHE SERVERS

150 The Low-Cost Road to the Internet

We test six cache servers that provide speedy access to the Internet. Is one right for your business? *By Jeffrey Witt*

SOFTWARE

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Clear some space on your hard disk: We show you the best of the best in 20 categories of shareware. *By Sheryl Canter*

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The Compaq MP1600 Microportable Projector is one of a new breed of lightweight portable projectors.

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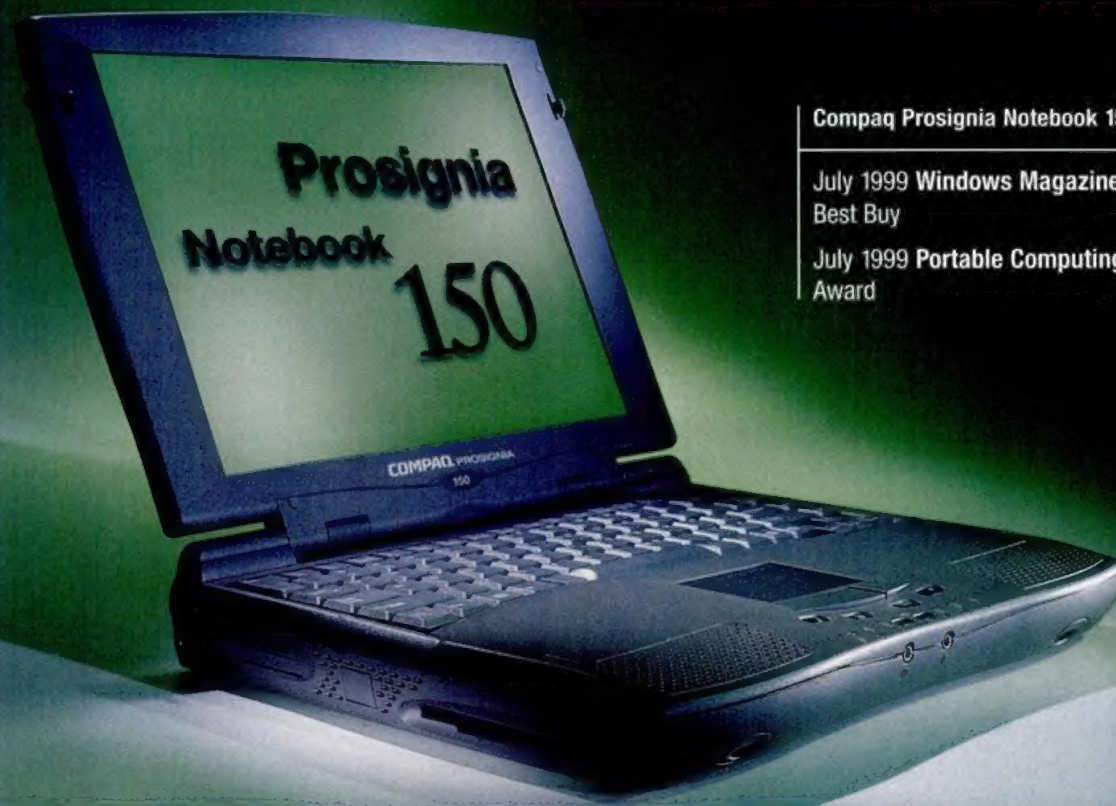
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Compaq Prosignia Notebook 150 Awards:¹July 1999 Windows Magazine — WinList:
Best BuyJuly 1999 Portable Computing — Lizzie
Award

\$1499. Compromises not included.

Call now to get a great price on the award-winning Prosignia Notebook 150 and get all the power of an AMD® processor. Looking for an affordable notebook without sacrificing advanced performance and technology? Well, look no further. Because for only \$1499 the Compaq Prosignia Notebook 150 — powered by a 350/100MHz AMD processor — includes all you need to help your business grow more productively. For one, it's ready to go right out of the box, with pre-loaded software that immediately gets the power of the Internet working for your business. What's more, the CD-ROM drive, diskette drive, and modem are built right in. Add all that to business advantages including 24x7 dial-up tech support, and you'll agree that the Prosignia Notebook 150 is a bargain at any price. And a steal at this one.

PROSIGNIA NOTEBOOK 150

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- Li-Ion Battery
- Microsoft® Windows® 98
- Free* Trial of Compaq Online Services
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PROSIGNIA NOTEBOOK 150

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- 14.1" CTFT (1024 x 768) Display
- 24X Max CD-ROM/3.5" 1.44MB
- Compaq V.90 Data/Fax Modem⁴
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Groovy Portables

The rumor mill proved correct: At New York's recent MacWorld trade show, Apple CEO Steve Jobs took the wraps off the company's much-ballyhooed iBook portable computer. Targeted squarely at consumers and students, the new iBook portables will sell for \$1,599 and start shipping in September.

The new iBook itself isn't square, though. It has curved edges and corners, with rubber figuring



APPLE'S AIRPORT: Wireless networking on a shoestring.

prominently in the design. The curves and the Austin Powers-like colors are intended to project a distinctly hip image. The 6.6-pound iBook will be available in two translucent color schemes—tangerine and blueberry—and will have a 12.1-inch TFT display with a resolution of 800 by 600 pixels, an ATI Rage graphics chip, a 300-MHz G3 processor, a CD-ROM drive, 32MB of RAM (expandable to 160MB), a built-in modem, USB and 10/100 Ethernet ports, and a full-size keyboard. The operating system is Mac OS 8.6. Jobs touted the battery life as over 6 hours (Mac OS 8.6 includes advanced power-management schemes).

Just as many portable PCs are shipping with wireless technologies, iBook users can roam up to 150 feet from \$299 base stations that plug into telephone jacks (users must also purchase \$100 cards for their iBooks to communicate with the base stations). Dubbed AirPort, the wireless technology is

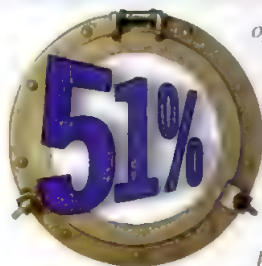
radio-based and has a data-transfer rate of 11 Mbps. Apple developed the wireless components in partnership with Lucent.

A Wider Web Search

Internet search engines can certainly cough up plenty of hits, but in fact, they're probing only about 16 percent of the entire Web, at best. Given the relentless increase in the number of Web pages posted daily, existing search engine technology simply can't keep up. Espin Brodin, CEO of Oslo-based FAST Search and Transfer, thinks he has the answer and has

set out to prove it with the recent launch of FAST Search, a search engine that probes 200 million Web pages for every query tossed its way.

Unlike other search engines, FAST technology scales linearly and thus, say developers, will be able to cover the entire Web—all 800 million pages. The company plans to form partnerships with Web sites for building, say, the world's largest shopping site. A demo of the technology is available at www.alltheweb.com.



of respondents to a recent PC Magazine Online poll told us the portal they use most is Yahoo!. Of the six other portals we asked about, only two made it into double digits—Excite and MSN.com, with 13 percent each. Trailing far behind were AOL.com (9 percent), Netcenter (8 percent), GO Network (3 percent), and Lycos (3 percent).

IBM's 11-Terabyte Storehouse

Last year, IBM wowed the industry with its matchbook-size 340MB Microdrive. This year, IBM launched what the company claims is the world's largest storage server, the Enterprise Storage Server (code-named Shark), which is about the size of a shower stall and handles up to 11 terabytes of data. In practical terms, the system could hold all the contents of the Library of Congress—and then some. With the announcement, IBM has positioned itself as a serious competitor to EMC, which already dominates the enterprise storage market.

The fledgling enterprise storage market is booming, and all signs point to more of the same. One ripple effect of the Internet's growth is the surge in demand for storage, propelled by the millions of transactions zipping around cyberspace. Companies are eager to capitalize on one-to-one marketing by turning the massive amounts of data that Web sites collect into useful information for targeting customers. According to Forrester Research, the demand for disk storage in large companies is growing more than 100 percent annually.



Sites to Sit On

Sure, you've bought books, CDs, and flowers, but have you started to think bigger? Why not buy a \$3,000 couch online? If you're not crazy about the idea, you're not alone. So far, only 1 percent of the \$75 billion furniture market has found its way onto the Web. Nevertheless, *Forbes* magazine recently identified furniture as one of the hottest up-and-coming online retail categories, and a flurry of new Web sites is proving that prediction correct. On June 24,

HomePoint.com (www.homepoint.com), which offers not only furniture but also accessories and art, debuted online. It was followed a month later by Living.com (www.living.com), a site that offers thousands of upscale furniture choices in 23 categories and an online design magazine. These two sites have joined the aptly named Furniture.com (www.furniture.com), which recently redecorated its site and now features a personal shopping service and a short course in Furniture 101, along with 50,000 items from 100 manufacturers.



LOOKS COMFY: Furniture shopping hits the Web.

Chemical Computers

Scientists at Hewlett-Packard and UCLA's Department of Chemistry and Biochemistry recently made a significant breakthrough in the fledgling field of chemically assembled electronic nanocomputers (CAENs), a technology that may eventually produce tiny processors that are billions of times faster than those of today and that could be manufactured at a fraction of the cost. As reported in the *Journal of Science* recently, the researchers successfully produced a logic gate—the building block of a processor—out of a synthetic molecule called rotaxane.



The significance of the experiment lies in the molecular dimensions of the gate, but the technology is also promising because it's cheap. You probably know Moore's Law, which predicts that transistor density will double every 18 months, but you may not be familiar with Moore's Second Law, which states that manufacturing costs increase on a semi-log scale. In other words, the cost of making chips is skyrocketing. According to some predictions, the price tag of a new plant producing conventional chips could be between \$30 billion and \$50 billion by 2010.

Internet-on-a-Chip

The Internet has become such an important resource to so many people that we're looking to connect all sorts of devices to it, from cell phones to household appliances. The problem is that the hardware requires many features to make this possible, including a TCP/IP stack, a browser, an e-mail client, and more.

Seiko Instruments, in partnership with iReady, has packed all this into a single chip: the iChip. Because all the software is right on the chip, the iChip needs only 64K of shared memory. According to Seiko, such integration results in one-fourth the component costs and requires just one-hundredth of the power used in conventional hardware designs. And by offloading the complex commu-



With the iChip, all sorts of appliances can tune into the Web.

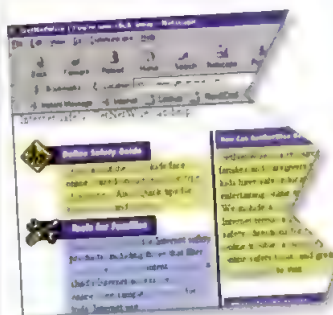


nications tasks, the device can use a much simpler and less expensive CPU.

The iChip is likely to show up initially in cell phones and pagers, but it could also be used in appliances that can notify a repair service of any breakdown and in gaming devices that can easily communicate for multiplayer competition.

Safe Surfing For Kids

Parents now have a single Web site where they can get the latest information on and tools for protecting their kids from the dark side of the Web. At the recently launched GetNetWise.org (www.getnetwise.org) site, you'll find the Internet Safety Guide, which explains the potential safety risks of e-mail, chat rooms, and Web sites. Another section describes technologies that monitor Internet usage, filter objectionable content, and control computer use. The site also has links to law enforcement and advocacy groups in case you need to report online trouble. A guide to



GUIDING HAND: GetNetWise.org is a one-stop site for kid-safe Web surfing.

kids' content provides links to sites designed for children.

Nearly 30 industry players, including America Online, AT&T, Bell Atlantic, Disney Online, ExciteAtHome, Lycos, MCI WorldCom, Microsoft, Network Solutions, and Yahoo!, cooperated in launching the site.

Top Web Shopping Sites

1	amazon.com (562,000)
2	ticketmaster.com (280,000)
3	buy.com (273,000)
4	sony.com (226,000)
5	mothernature.com (196,000)
6	iprint.com (174,000)
7	drugstore.com (154,000)
8	hallmark.com (153,000)
9	netmarket.com (138,000)
10	cdnow.com (116,000)

Source: PC Data, June 1999
Projected number of purchasers.

Magic Chips

Sun Microsystems wants to know if you believe in MAJC. The company recently announced a chip dubbed MAJC, an acronym for *microprocessor architecture for Java computing*. The all-in-one chip features a unique parallel processing architecture for graphics, voice, and video. Sun Fellow Bill Joy built the chip to handle tasks such as 3-D graphics processing and digital communications more efficiently than competing media-processing chips. But the company is entering choppy waters. Several similar chips have failed, as multimedia standards have reshuffled with lightning speed.

Top Web Health Topics

If you've visited any health-related Web sites, you probably spent most of your time finding out about your own or your family's ailments. Here are some of the most popular health topics researched on the Web.



1 Ailments



2 Drugs



3 Nutrition



4 Treatments



5 Exercise



6 Natural remedies

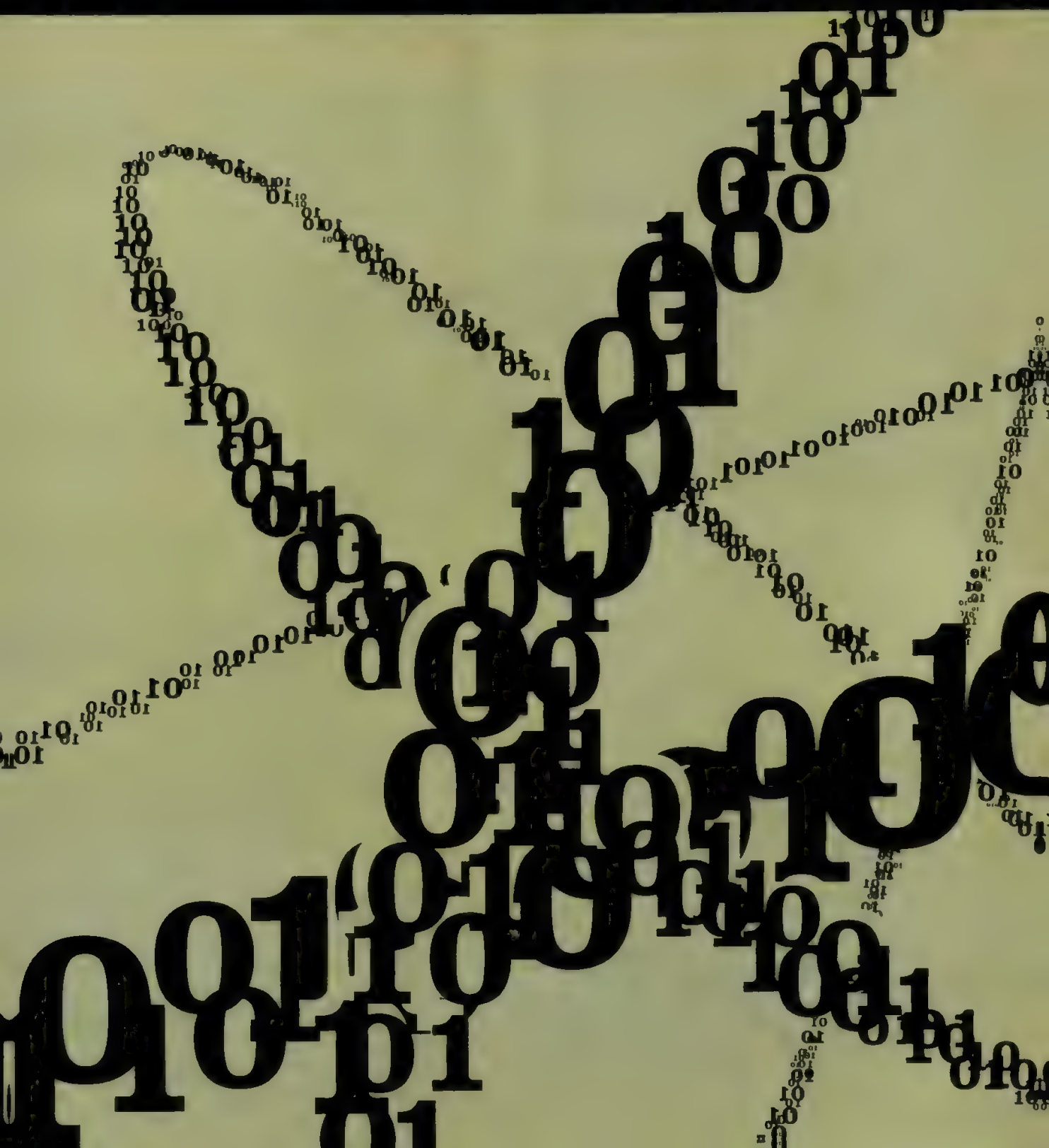
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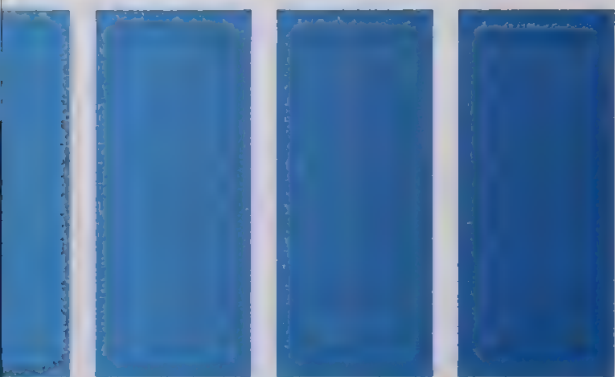


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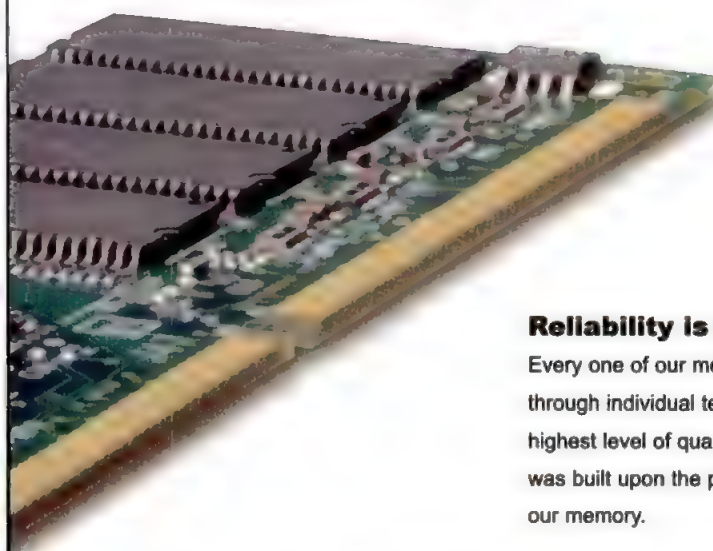
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LETTERS

PC PERFECTION

I enjoyed your article on choosing the perfect PC ("The Perfect PC," July). The article is very informative and is sure to benefit anyone needing to buy a new PC for either personal or company use. I especially liked how you categorized the different users (home, corporate, road warrior, and so on) instead of focusing on, say, the perfect portable as was done several years ago.

As one who is fairly knowledgeable about computers, I can now point potential computer buyers to this article with the understanding that they will find the information relevant to their needs.

DENNIS DEVEAUX
Calgary, Alberta, Canada

Since the editors and technical staff at *PC Magazine* discussed how to configure the perfect PC, and it really sounded great to me, why didn't you give us some idea of the best place to start to look for a platform that could accept all the items? Looking at all the ads, I don't think I have found anything from a company that you show as having receiving a grade of A that comes close to anything you suggest, especially with a price of around \$2,000 (although you did recommend an Intel Celeron-based unit as a second PC for Web surfing.) Sony offers the nearest I could find to your "perfect PC," but I don't think it would make the changes you suggest.

Where could I find a good company that would make up a PC such as you suggest for the price you suggest, or did you have your tongue in your cheek?

RUEL WAGNER
via the Internet

We based our *Perfect PC* configurations primarily on what we feel each type of user would need, then went to the Web sites of the major PC vendors (Compaq, Dell, Gateway, HP, and IBM) to build the systems online. Yes, you probably won't be able to walk into a store and get our exact configurations off the shelf, but

the major build-to-order vendors (or your local system integrator) should be able to put together such systems for close to the prices we indicated.—Ed.

I want to thank *PC Magazine* for the great July issue. As a network consultant, I enjoy comparing my experiences from the past year with the experiences reported by *PC Magazine* readers. The Perfect PC articles left me quite disappointed, however. By my count, there are only four complete sentences that mention anything about backup. You mention data redundancy through RAID several times, but this is no protection against fire, data corruption, or accidentally deleted files. By my standards, none of the perfect PC systems make it onto my perfect list. Backup is a

"Where could I find a PC such as you suggest for the price you suggest?"

complex issue with many options, so it is a difficult one to address well in limited space. Maybe you can devote a headline next year to how to pick the perfect backup.

JAMES STUMP
via the Internet

In "The Perfect PC," you have recommended that power users get systems with 4X AGP, but I have yet to find any motherboards or chip sets that support this standard at this time. Have I missed something?

DAVE GRETH
via the Internet

No, you didn't miss anything. We should have suggested users consider getting systems with 4X AGP-capable graphics adapters to allow for upgrading to 4X AGP-capable motherboards in the near future if they are really into gaming.—Ed.

As the president of a company that specializes in locally built systems, I commend you for finally recognizing that a locally built-system market segment exists. Though we also sell HP and IBM systems, we can offer far more flexibility and variety to our customers by offering them custom-built systems. As you noted, these systems are reliable, customers are satisfied with repair and tech support, and most would buy again. Perhaps your finding that they have an overall greater need for repair is due to the fact that the end user probably knows someone at the local store and is able to get help.

As one of hundreds of dealers that build and sell custom-built systems, I am small and could never be compared with a Compaq, Dell, or Gateway. But taken together, we are a potent force and one that should be recognized by your publications when comparing new systems and by end users when considering where to buy new systems. There is a lot to be said for local support from someone you know and trust.

RICHARD WEEKS
Salt Lake City

In the table "Removable Storage Options" in "The Perfect PC" (page 108),

something does not add up in the column labeled "Media cost per megabyte."

The cost of media for 100MB Iomega Zip Drives should come out to about \$0.10 per megabyte, not \$1.00 per megabyte. This assumes that the retail cost of ten disks in a pack is \$99.95, for a cost per disk of \$10.00. This number divided by 100 megabytes would be 10 cents per megabyte.

Also, the 250MB Iomega Zip Drive's disk, at a retail price of \$16.50 each (in packs of six for \$99), would work out to 6.6 cents per megabyte. Otherwise—useful article.

BILL HARVEY
via the Internet

We admit it: We made mistakes in the math. Thanks to all our astute readers who set us straight.—Ed.

STUCK AT THE OFFICE

A major problem not mentioned in your First Looks article about Microsoft Office 2000 ("Help for Small Businesses," July) is the sacrifices Microsoft has made in some of its applications to integrate with the Internet further. For example, the auto-formatting of numbers and bullets in Word 97, which made note taking effortless, has been entirely destroyed in Word 2000. Word 2000 indents everything and forces the user to use specific symbols at certain points in the page. The user has little or no discretion in designing an outline. In fact, you can't even create a simple numbered grocery shopping list without Word 2000 indenting it.

According to Microsoft's Office 2000 technical support, this change was necessary so that Word 2000 documents could be easily translated into HTML. As a graduate student who uses his laptop to take notes in class, I have already wasted too much time fighting the Word 2000

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1591

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- Keyboard, Floppy, Mouse
- Mid Tower Chassis

1755

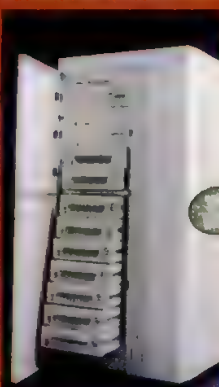
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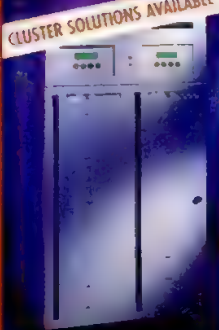
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- 16MB Cache
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- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

Q (3) 36GB 8,000RPM LVD HD	10,200
Q (3) 18GB 8,000RPM 15.0ms LVD HD	7928
Q (3) 1GB 8,000RPM 5.0ms LVD HD	6458

STC 20 BAY

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- Q (2) 4 Channel RAID 5 U2W Controllers
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- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

72GB Solution	
Q (8) 9 1GB 7200RPM LVD HD	18,750
72GB Solution	
Q (8) 9GB 10,000RPM 15.0ms LVD HD	20,300
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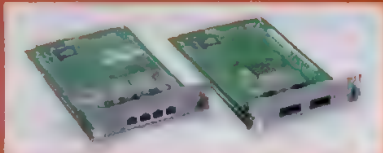
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program simply to place hyphens, bullets, and numbers where I direct it. Simply put, consumers need a robust word processing program, which is what Word 97 was. If I wanted major Web integration, I'd purchase an HTML editor and use my Web browser.

I believe I will take Microsoft up on its 30-day money-back-guarantee offer and reinstall Office 97. At least then I know I will be getting what I paid for—an office suite, not an incredibly intricate \$600 Web browser.

BRENT J. JAMISON
Sacramento, CA

ROCK, PAPERLESS, SCISSORS

I was very interested in your report of vendors' plan for expansion of electronic bill-paying services through the development of electronic bill presentment ("Paperless Bills," Trends, July). You comment that "most people, however, still prefer to pay by paper check and snail mail."

And with good reason. The services are convenient for paying but iffy for accounting. CheckFree, for example, has abandoned its option for laser check service. As a result, the user can no longer be assured of having any proof of payment for tax purposes, since there is no way to receive proof of payment from a direct-debit transaction. This means a nightmare at tax audit time.

The services would do better to improve their basic options to include helpful features, such as the laser check option, before trying to expand into new arenas.

DAVE PERRY
Lawrenceville, NJ

PLAY YOUR BEST CAD

When I read the First Looks review "Designs on Your Desktop" (July), in which AutoCAD 2000 was described as "an industry standard" and "the world class of CAD," I knew one thing about the author: He doesn't make a living doing CAD.

I started using CAD in 1985 when Bentley introduced a microcomputer version of Intergraph's Interact CAD software called MicroStation. Although it ran on computers with a fraction of the power of the VAX minicomputers that Intergraph typically used, it had features that made it an instant hit. One of the characteristics of Intergraph that Bentley maintains is its interactive nature. All elements of the design are manipulated interactively on the hard disk.

AutoCAD, which was developed originally for microcomputers with slow hard disks, chose to load all of its graphics into RAM where they could be manipulated quickly. This difference in philosophies does not mean much on small, uncomplicated projects, but on large projects such as digital terrain mapping (DTM) it is painfully obvious. That is the

Corrections and Amplifications

In our story "Printers: Service & Reliability" (July 1999), we incorrectly stated that Okidata received a grade of D grade in our 1998 Service and Reliability Survey. It in fact received a C.

In "A PC for Small Spaces" (Pipeline, July), the measurement of the footprint should have been expressed as 12 inches squared instead of 12 square inches.

In our review of the HP OmniBook 901T ("Thin & Light Notebooks," August, page 166), we characterized its 2:16 battery life as "rather low." In fact, its score was the third-best among the nine thin and light machines we tested.

whole reason AutoCAD developed the ability to load only prenamed pieces of larger drawings. The catch is that before you can prename a piece, you have to open the whole thing. I have worked with some large DTMs that simply can't be opened with AutoCAD. MicroStation does not have this limitation.

AutoCAD has a place in the CAD world for small projects without a lot of data, but if you truly want to go world-class, go with MicroStation. With this package, you get to see the whole world, not just a piece of it.

PAUL E. HUFF
Atlanta

LISTEN CLOSELY

I just received the July issue of *PC Magazine*. The Tutor article about MP3 is interesting ("MP3: Music on Your PC," Solutions), but one item dismays me—the reference to MP3 digital music having the ability to produce "CD-quality sound." There was no "like" or "almost" in the sentence. It basically stated that MP3 audio quality is the same as that of a CD.

This statement is far from true. For the most part, MP3 files, if well recorded, sound fairly decent, but they are by no means as crisp as CD audio. CDs are sampled at over twice the highest frequency audible to humans, which makes for a pretty good approximation of the original analog signal.

The folks who like vinyl will tell you that a CD misses some of the original "warmth." We traded some warmth for a higher signal-to-noise ratio in CDs, which I think was a good trade. MP3 appears to be going in the other direction, however. My fear is that, over time, people may settle on this mediocre format, and CDs will go the way of vinyl as opposed to going toward DVD, which could hold a full surround-sound signal. MP3 has its place, but please do not advertise it as CD-quality.

RON VISSERS
via the Internet

THE MICROSOFT TOUCH

Having read John C. Dvorak's comments on Clear and Simple's file management package DiskJockey 98 (Inside Track, July), I followed his recommendation and bought it. It is everything he says it is and more, although at this point I have not explored all of its myriad capabilities. The viewers are terrific, and the ability to scan, view, and extract specific files from zipped archives is a thing of beauty. It also seems the overall access speed of this program

is at least twice as fast as Windows Explorer's.

The only thing that bothers me about Dvorak's comments is that he wishes Microsoft would buy it from Clear and Simple and incorporate it as the Windows file manager. Doesn't he realize that if Microsoft's programming staff ever got hold of the code they would immediately tweak it until it was as clunky as Windows Explorer, or worse? Come on, John! Let's leave Gates's gang out of the loop on this one.

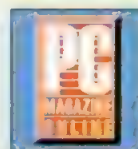
CLIF KIRTON
Sylvania, OH

MORE THAN JUST A PLAYFUL PUP

In the First Looks article "Win2000: A Worthy Beta" (First Looks, July), you say, "Windows 2000 has to fight off the ankle-chewing efforts of Linux with attractive flexibility and tiers of pricing." I think Windows 2000 has to fight off a real threat from Linux. (Nice for Microsoft to offer tiers of pricing—Linux has only one price and that's free.) Linux is a stable, mature, and fast operating system that is doing more than "ankle chewing" to Microsoft Windows.

MIKE KITAIF
via the Internet

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The Doctor Is Online

The prognosis is excellent for health Web sites.

Can the Web cure all the world's ills, both figuratively and literally? Although the online health market is still in its infancy, market research firm Jupiter Communications projects that on the consumer side the industry will reach \$1.7 billion by 2003. In search of these potential profits, several new sites are battling for mind share, while others are scrambling to consolidate and capitalize on early success.

The majority of the sites offer health advice and information, and are supported by advertisers. Most consumers searching for health information online are women, owing to their traditional role as caregivers. "Women make the health care decisions within a family. When a child or spouse gets sick, it's usually the woman who takes the lead in researching what's wrong and what treatments can be provided," says David Restrepo, an analyst with Jupiter Communications. More than 58 percent of the health information users read online is related to family or personal ail-

ments, according to Jupiter.

The real money will probably come from e-commerce in the form of prescription refills, vitamin supplements or nutraceuticals, and over-the-counter medications. The sites with the best chances of survival will probably provide both health information and access to health-related products. Recent alliances include drkoop.com with Drug Emporium and AOL, America's Health Network with Fox, PlanetRx with News Corp., and OnHealth.com



with Drugstore.com.

Most health sites are currently restricted from refilling drug prescriptions.

Even sites such as drkoop.com can only help consumers refill prescriptions by linking them to

Web sites run by traditional drugstores.

But regulations are expected to be eased in the near future. Jupiter predicts that online prescription drug spending will soar from \$10 million in 1999 to \$970 million in 2003. That's still less than one percent of the total

retail prescription drug market,

but even this tiny percentage is a very attractive source of revenue for the burgeoning health sites.

As for the possibility of actual consultations between patients and doctors taking place online, don't expect it anytime soon. While doctors are free to dispense information and advice, face-to-face consultations are still required for diagnosing conditions. Nevertheless, as videoconference techniques improve, you may expect to see lower-end medical needs taken care of without visiting the doctor's office. With improved screen technology it's already possible to e-mail X-rays to a patient's computer, and enhanced video may help medical practitioners make preliminary diagnoses.

Is it too late for new entrants to the field? The surge in niche markets—sites for women, seniors, and children and ailment-specific sites—is encouraging to newcomers, but industry analysts say that government regulations are holding back many sites from reaching their full profit potential.

Nevertheless, many consumers would agree that this is one area that requires strict supervision. There are significant dangers related to doctors writing prescriptions or ordering procedures without meeting their patients in person. Despite these concerns, one thing is certain: Good health information is only a click away. —Sharon Nash

LEADING HEALTH SITES

www.americasdoctor.com:

Live discussions with doctors, information on health issues, and access to products.

www.betterhealth.com:

Coverage of physical and emotional health, feature articles, and support groups. Part of the Village family.

www.drkoop.com:

Health information, advice from doctors, and online support groups. Alliances with DrugEmporium.com and AOL.

www.thehealthnetwork.com:

Multimedia health information and live Webcasts of medical procedures. Joint venture of Fox and America's Health Network.

www.healthylideas.com:

Women's health issues, ques-

tion-and-answer sessions, chat rooms, and product suggestions. Part of Women.com.

www.intelhealth.com:

Catalog of health products, access to Johns Hopkins health library and drug databases. Joint venture of Johns Hopkins University Hospital, Health System, and Aetna U.S. Healthcare.

www.mayohealth.org:

Information on health and medical topics from the Mayo Clinic.

www.mediconsult.com:

Detailed information on how to deal with chronic conditions and related issues.

www.medscape.com:

Targeted at health professionals. Medical reports and articles for informational and educational purposes. Medscape Consumer

will be available soon.

www.planetrx.com:

Online pharmacy and health information service. Recent investment from News Corp.

www.onhealth.com:

News, health information databases, and weekly talk show. Alliance with Drugstore.com for online pharmacy purchases.

www.thriveonline.com:

Women's health issues: medical, fitness, sexuality, nutrition, and weight information.

www.webmd.com:

Subscription service for doctors. Consumer site includes news, information, a physician directory, and condition-specific support groups. Planned merger with medical transaction company Healtheon.

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Microsoft Millennium

Rumors of its death are greatly exaggerated. For several years, we've been hearing that Microsoft is planning to migrate everyone to an operating system based on the Windows NT kernel and that the current version of Windows 9x, be it Windows 95 or Windows 98, would be the last. But as plans for Windows 2000 (formerly known as Windows NT 5) became clearer, Microsoft said there would be at least one more major release of Windows for consumers.

Microsoft recently shipped the first developers' release of that OS, code-named Millennium, to its software and hardware partners. The commercial version should ship next year.

The company is positioning Millennium as the operating system for the home, with Windows 2000 being the OS for business. Since most people use their home PCs for sharing photos, listening to music, and watching videos, Microsoft will attempt to make the OS a better platform for acquiring, storing, and sharing digital media.



Millennium will also focus on improving the consumer's Internet experience. Microsoft is closely studying the ways families use the Internet and intends to make configuration simpler. Millennium will also support Universal Plug and Play to simplify connecting computers together and the OS will enable links to appliances and entertainment systems.

What does Millennium mean for small businesses? Many small companies have resisted Windows NT and stayed with Windows 95 and 98. Though there isn't any technical reason why Millennium can't be used in an office, Microsoft will be pushing to migrate businesses to Windows 2000—a move they may be very reluctant to make, no matter the benefits. —Ben Z. Gottesman

INSIDE



PC LABS

Does the PIII Improve Surfing?



Intel's massive Pentium III advertising campaign promises that the Pentium III provides an enhanced Internet experience. PC Labs decided to put this claim to the test. Would the PIII deliver richer 3-D graphics, 2-D animations, and video and audio streams? In conjunction with this issue's CPU story ("Processors: The Right Speed for You"), we visited numerous Web sites highlighted on Intel's own WebOutfitter Web site—a free Web-based service for PIII users. According to Intel, content on WebOutfitter is optimized for PIII systems.

The only significant difference beyond faster clock rates between a Pentium II and Pentium III is Streaming SIMD Extensions (SSE) technology. SSE's SIMD floating-point capability can speed up portions of the 3-D pipeline, particularly 3-D transform and lighting calculations. SSE's New Media Instructions and memory streaming can accelerate MPEG-2 encode and decode functions. And SSE algorithms can improve 2-D graphics, animations, and audio processing. Here's our question: Can Web users with 56K modems actually realize these benefits on Web sites today?

To find out, we signed up for the Intel WebOutfitter service and waited a few days for our WebOutfitter CD (Version 2) to arrive in the mail. We loaded all the included plug-ins or controls on the PIII from the CD-ROM and loaded the same software from the respective vendor sites on the PII (we made sure both systems had the same version). We configured 450-MHz PII and 450-MHz PIII systems identically, loaded Microsoft Internet Explorer 5 under Windows 98, and then visited sites listed on WebOutfitter over 56K connections, and, in some cases, our T1 network connection.

We had hoped that Autobytel.com—especially its 3-D virtual showroom, which features Metacreations scalable Metastream technology—would provide us with

a rich interactive experience on the PIII. It did not. Everything looked and felt the same as it did on the PII, with similar rendering quality and speed. We visited another Metastream site called Styleclick and experienced no difference downloading, viewing, or manipulating various Metastream-enabled items. Same results at Free-space2, where the Metastream-enhanced

Ship of the Week Gallery displayed at the exact same quality and speed on both systems.

Intel suggested we try out Brilliant Digital's Digital Projector plug-in, but playback of a five-minute "Xena: Warrior Princess" animation from www.multipathmovies.com showed no speed or qualitative differences between the two test systems. We also tried many Flash-

enabled sites but again found no differences.

We did see very noticeable improvement with the latest version of Blaxxun's Contact software (which allows viewing and navigating of 3-D VRML worlds optimized for the PIII) running a NURBS (non-uniform rational B-spline) demo on Blaxxun's developer site. Web sites rarely use client-scalable NURBS technology, and most sites are hesitant to force users to download complex 3-D models.

We did observe minor frame-rate or rendering quality differences on the Excite Extreme, Cartier, and VRLX sites, but these improvements were either barely noticeable or not meaningful in our opinion. In fact, we thought the Cartier watch looked worse with the extra lighting effects displayed on the PIII than it did on the PII. Our tests with the T1 connection showed no discernable improvements.

As we point out in our CPU story, we did see sizable gains in some standalone SSE-enabled applications, but our PIII Web experiences left us unimpressed. Improvements should come as scalable 2-D and 3-D graphics technologies are further and better exploited and as Internet connection speeds become universally faster. —Nick Stam

SITE SAMPLING

During PC Magazine Labs testing, our Pentium III system showed practically no improvement over our Pentium II system in accessing Web sites. We did notice a difference in accessing three sites but the improvements were minimal.

✓ YES	✗ NO	Enhanced speed	Enhanced quality
www.autobytel.com		✗	✗
www.bde3d.com		✗	✗
www.cartier.com		✗	✓
www.club		✗	✗
ministryofsound.co.uk		✗	✗
www.confetti.co.uk		✗	✗
www.cybertown.com		✗	✗
www.exciteextreme.com	✓	✗	✗
www.homebuilder.com	✗	✗	✗
www.lastminute.com	✗	✗	✗
www.vrlx.com.au	✓	✗	✗

RESEARCH

The Networking of Everyday Things

What if everything could talk to everything else? What if light switches, wristwatches, FedEx boxes, shipping pallets, forklifts, and telephones could all talk? Many small electronic productivity devices can communicate wirelessly with one another, but few can network. The difference is critical: Communications are usually directed by a synchronization program, while networking gives devices a generalized framework within which to exchange information. Bluetooth and IRDA 2 address this need with self-establishing networks, but both are built on a client-server model.

Can smaller, less sophisticated devices network on a peer-to-peer basis? What if these networks were self-organizing, with topologies that could vary from moment to moment? Researchers at MIT's Media Lab are trying to answer these questions, and they're trying to imagine new devices based on virtu-

ally free networking. The applications for pagers, cellular phones, watches, and PDAs, are obvious, but imagine a warehouse that tells you the location of the carton you're looking for no matter how often it's been moved. Or having a lamp know what room it's in, when it should turn on or off, and that it should add light bulbs to the list on the refrigerator when one burns out.

Researchers Nelson Minar and Kwindla Kramer are working on Hive, an architecture for mobile code that harnesses snippets of Java that move themselves around the network to get dissimilar devices talking to one another.

Toys that think are a common means of expressing sophisticated new technologies at the Media Lab. Take researcher Robert Poor's multicolor-flashing, touch-sensitive orbs, called



TALK TO ME: In this simplistic, self-configuring network, each orb communicates its color to its neighbor.

Nami—a Japanese word for wave. Each baseball-size orb establishes communications with neighboring orbs and transmits information about the color it's displaying. Each orb in turn displays the same color, then passes the information to another orb. A touch

on any orb initiates another ripple of colors.

The experiment is a testbed for a new networking environment called Hyphos, which lets potentially thousands of small, short-range devices build an ad hoc network that finds the fastest way through the nodes using cheap microcontrollers, with hardly a hint of an operating system. Poor's research indicates that with appropriate infrared or radio technology, devices that cost a few dollars, and ultimately mere pennies, will be able to network quickly and efficiently.—*Bill Machrone*

Protect Your Digital Identity

Chances are good that you or someone you know has been victimized by a once rare but now increasingly common crime called identity theft.

The concept is simple enough: Someone gains access to enough of your personal information to be able to obtain credit cards, bank loans, or a driver's license in your name. The permutations of the crime are endless, but the results are predictable: a bad credit rating, dunning calls from bill collectors, and perhaps arrest on suspicion of crimes committed by someone masquerading as you.

The spread of personal computing, networks, and the Internet, have made the identity theft problem more serious. In the past, someone trying to steal your identity would have to gain access to paper records by breaking into your home or car, sifting through your trash, or combing public directories. Now almost all the data is available to any computer linked to the Internet.

In our Future Technology issue of June 22 (www.pcmag.com/features/future/identity01.html), we noted that the many bits of your personal information stored in various databases around the world can create a valuable commodity: Your digital identity. It's not surprising that something of value—even if digital—would be subject to theft. Especially if it's relatively easy to steal.

How common this kind of crime has become is hard to say, but according to a recent federal government investigative report, one leading credit information service reported 35,000 consumer complaints of fraud in 1992, two-thirds of which involved identity theft. In 1997, that same

service reported half a million cases of fraud, with two-thirds again involving identity theft. There's no reason to believe that this astounding growth rate has slowed.

Congress addressed the problem by passing the Identity Theft and Assumption Deterrence Act of 1998. The new statute strengthened existing federal laws that cover identity theft, arming various enforcement agencies, such as the FBI and the Secret Service, with more authority to combat such crimes. It also provided for a central clearinghouse for consumer complaints and information.

The Federal Trade Commission's Bureau of Consumer Protection is taking up the second mandate of the new law by creating a group that will address identity theft specifically. Check out its consumer protection Web pages at the main FTC site (www.ftc.gov) and at a multiagency consumer information Web site (www.consumer.gov).

Beth Grossman, the FTC bureau's identity theft program manager, said her group has two goals: To disseminate information to help people protect themselves and to provide assistance for victims. You'll be able to file an identity theft complaint with the FTC on the Web. Grossman hesitated to blame the Internet for this problem. "Identity theft didn't begin with the Internet, but it certainly makes the flow of personal information easier," she said.

I think she's going too easy on the Internet, but I agree that our focus should be on deterring misuse of the technology and those who misuse it rather than on blaming the technology itself. Above all, it's nice to see the government use the same technology to attack the crime. Everyone should read the FTC's information on protection and recourse. Your digital identity becomes more valuable—and more vulnerable—every day.

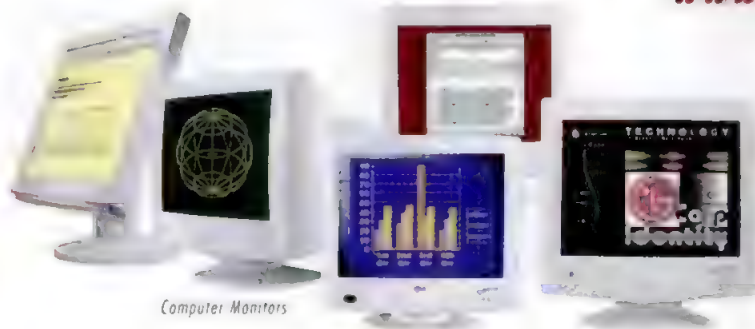


Jake Kirchner



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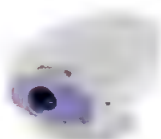
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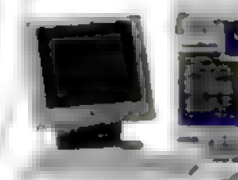
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Windows NT 4.0

HP 10/100 PCI NIC

TopTools manageability:

DMI 2.0 compliant

MaxiLife H/W

monitoring and

LCD panel

ConfigTailor for S/W

deployment and

recovery

Y2K compliant

3-year worldwide warranty

D7984T

\$2,596*

Kayak XA-s

Desktop—Dual-

Processor Capable

Pentium III Processor

550 MHz

128 MB ECC SDRAM

9.1 GB UW SCSI HD

Evans & Sutherland

AccelGALAXY

graphics card

32x CD-ROM

Windows NT 4.0

HP 10/100 PCI NIC

TopTools manageability:

DMI 2.0 compliant

MaxiLife H/W

monitoring and

LCD panel

ConfigTailor for S/W

deployment and

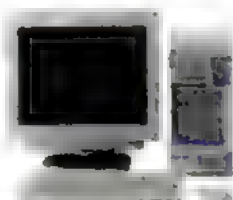
recovery

Y2K compliant

3-year worldwide warranty

D7989T

\$4,097*



Kayak XU

Dual-Processor/RAID
Capable

Pentium III Processor

550 MHz

128 MB ECC SDRAM

9.1 GB UW SCSI HD

Matrox Millennium

G200 graphics card

32x CD-ROM

Windows NT 4.0

HP 10/100 PCI NIC

Dual SCSI controllers

TopTools manageability:

DMI 2.0 compliant

MaxiLife H/W

monitoring and

LCD panel

ConfigTailor for S/W

deployment and

recovery

Y2K compliant

3-year worldwide warranty

D8920T

\$3,293*

Kayak XU

Dual-Processor/RAID
Capable

Pentium III

Xeon™ Processor

550 MHz

128 MB ECC SDRAM

9.1 GB UW SCSI HD

ELSA GLoria Synergy+

graphics card

32x CD-ROM

Windows NT 4.0

HP 10/100 PCI NIC

Dual SCSI controllers

TopTools manageability:

DMI 2.0 compliant

MaxiLife H/W

monitoring and

LCD panel

ConfigTailor for S/W

deployment and

recovery

Y2K compliant

3-year worldwide warranty

D6345T

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Internet Phones: Coming Soon

If you're one of those people who just can't stand to be off-line for even a minute, hang in there. By the end of this year, mobile phones with built-in Internet microbrowsers, e-mail, and fax capabilities will be commonplace. To get a feel for this upcoming evolution of personal communications, we took a look at three prerelease Internet phones—the Motorola i1000plus, the Qualcomm pdQ 1900, and the Samsung SCH-3500—all of which should be available on major nationwide digital wireless networks by the end of this year.

We should point out that in each case, the phones were final or very-near-final production models. The delay in getting these phones to customers centers primarily on the wireless networks' abilities to support the extra wear and tear on the network that data access will introduce. Even though the phones we evaluated will be available on nationwide networks (Nextel and SprintPCS), don't expect the extra data services to come online in every market simultaneously. In some cases, the phones will hit the market several months before any Internet features are accessible.

Even without the Internet connectivity, each of these phones is impressive. If you're in the market for a new digital phone and you have an eye toward the future, you'll want to give serious thought to these models.

Considering the small size of the i1000plus (\$299 list), it's hard to imagine the engineers at Motorola cramming any more features into this impressive handset. Not only is it a full-feature digital mobile phone, it also offers wireless IP connectivity, two-way radio, alphanumeric pager, and fax capabilities. The phone's data services come care of Phone.com's UP.Browser. With the service, you can check stock quotes, sports scores, and news headlines on the phone's four-line LED.

Each of these services offers neatly formatted, menu-driven information custom-tailored to fit the i1000plus display. E-mail services let you send and receive messages directly through the handset; you can also synchronize the in-box on

your phone with your desktop PC. Tegic Communications' predictive T9Text input is used to simplify typing on the keypad.

In addition, you can browse standard Web URLs, though we don't recommend it. Throughput is not the problem, but the microbrowser inserts a text-only "image" label for every graphic on a Web page. This result is a rather cluttered display. Still, you can connect the i1000plus to a laptop, 3Com Palm device or Windows CE device and use it as a wireless modem.

Though the phone's data services were still being tested as we went to press, the i1000plus is already available on Nextel's digital network. Expect data services to become available by the end of 1999.

Palm organizers are awfully handy devices, and surviving these days without a mobile phone is becoming increasingly difficult. Wouldn't it be nifty for a company to somehow combine the two so that you wouldn't have to carry both? Qualcomm must think so, because the forthcoming pdQ 1900 (\$799 list) is just that: A state-of-the-art digital mobile phone with a built-in Palm Computing device. Flip down the phone's keypad, whip out your pen, and you've got a mini-Palm.

Though much bulkier than the Motorola and Samsung phones, the pdQ 1900 seems light for a device with so many features. The 160-by-240-pixel LCD touch screen provides access to an address book, date book, microbrowser, and other apps. And since the phone is designed around the Palm Computing platform, you can load thousands of existing apps.

You can dial a phone number by tapping on an entry in your address book. Using a pen for this seems somewhat clunky when so many other mobile phones offer simpler speed-dialing options, but the fact that you can carry a single device that does the work of a Palm unit and a mobile phone is a big advantage.

Data services include e-mail, pager, and Web browsing capabilities. The pdQ 1900 can also synchronize with your desktop PC using standard Palm HotSync technology. Graffiti writing software supplies the data input. The pdQ 1900 will most likely be available on the SprintPCS network and through US West by the end of 1999. Qualcomm will also roll out the dual-mode pdQ 800, but no price has been set for that model.

Samsung makes some very slick little mobile phones. The SCH-3500 (\$149 list), a palm-size silver flip-phone, is no exception. This dual-band phone offers voice dialing for up to 20 numbers and a voice memo feature.

Its many data features include Internet access through Phone.com's UP.Browser and wireless e-mail and fax capabilities.

For Internet browsing, the SCH-3500's tiny four-line LED may not be ideal, but it works about as well as the i1000plus screen. Next year, Samsung plans to introduce in the U.S. market an Internet phone with a touch-sensitive screen the size of the phone itself; Samsung currently sells that model only in Korea. The SCH-3500 uses the SprintPCS network and is slated to ship in mid-September. —Michael E. Ryan



Make Your Site A Success

By Tom Giebel



So you've created the ultimate Web site. Before you sit back and wait for business to roll in, consider this: The latest Netcraft survey of Internet domains found that there are over 5 million sites on the Web. With all that competition, how can you hope to succeed? The answer, of course, is promotion. Many megasites are turning to traditional methods such as TV and print advertising. But for smaller sites, a lot of promotion can be done right on the Web.

Plan Your Attack

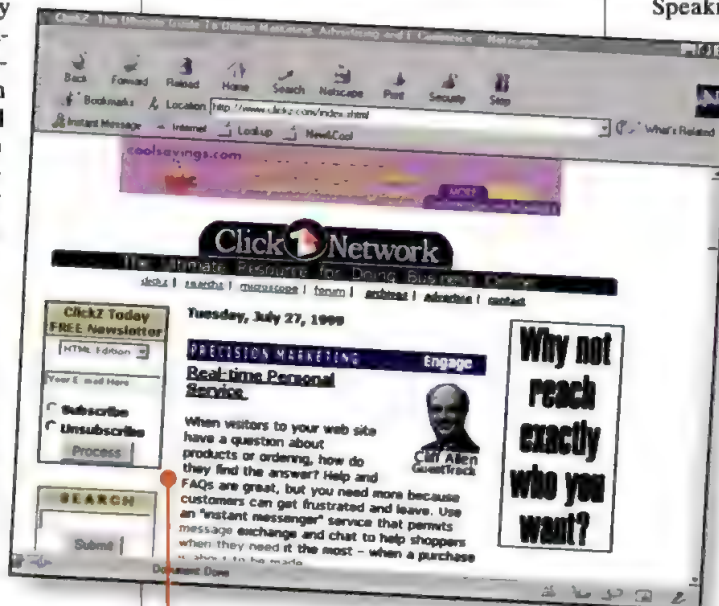
► The Web is full of sites that offer useful advice and tools you can use to promote your own site. **The ClickZ Network** (www.clickz.com) offers a steady stream of articles on promotion, marketing, and advertising, written by media industry experts. Subscribe to its newsletter for a regular dose of promotion tips. For a more hands-on approach, visit **Promotion World** (www.promotionworld.com) and **VirtualPromote** (www.virtualpromote.com), both of which offer tutorials and tools in addition to articles on promotion strategies.

Be Prepared

► Spending time promoting your site doesn't pay if it isn't ready. Broken links and poor HTML can doom your site to obscurity. Put your Web pages through a battery of link checks, browser-compatibility tests, and other diagnostics at both **NetMechanic** (www.netmechanic.com) and **Web Site Garage** (www.websitegarage.com).

Many search engines and directories rely on your site's meta tags for indexing, and having the correct tags can increase your ranking. If your site doesn't have meta tags yet, go directly to **META Tag Builder** (www.vancouver-webpages.com/META/mk-metas.html), fill out the form, and let the builder create them for you. Just paste the results into the <HEAD> tag in your home page. If you're already using meta tags, check in with the **Search Engine Tutorial Meta Medic** (www.northernwebs.com/set/setsimjr.html) to make sure they're formed correctly.

For a final flight check before launching your promotional campaign, read "The Web Marketing Checklist: 26 Ways to Promote Your Site" found at **Web Marketing Today** (www.webmarketingtoday.com/articles/checklist.htm).



Head to the ClickZ Network (www.clickz.com) for articles by media insiders on how to promote, market, and advertise your Web site.

Get Registered

► People won't stumble on your Web address by accident. More likely, they'll follow links from a search engine or directory. Going to the directory and clicking on Add URL is one way to get listed, but there are services available that help automate the process. **Submit Away!** (www.submit-away.com)

is a site that offers targeted submission services—meaning that you tailor your submission to specific directories and search engines. Another option is automatic submission—you fill out a single form which is sent to numerous sites at once. **Add It!** (www.liquidimaging.com/submit) and **SelfPromotion.com** (www.selfpromotion.com) both offer automatic submission, and you can find many more listed in **Yahoo! Business and Economy** (http://dir.yahoo.com/business_and_economy/companies/internet_services/web_services/marketing/promotion).

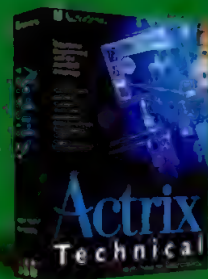
It pays to learn about how search engines and directories work before you start registering your site. **Search Engine Watch** (www.searchenginewatch.com) will teach you everything you ever wanted to know—and more. Pay attention to the "Webmaster's Guide to Search Engines," which offers tips on how to improve your ranking.

Speaking of ranking, you'll want to check whether your submissions are successful. About a week after submitting your site, use software such as **WebPosition Gold** (www.webposition.com) or the free service at **LinkPopularity.com** (www.linkpopularity.com) to check your site's search engine ranking. To see how your site ranks under specific keyword searches, try **Rank This!** (www.rankthis.com).

Advertise Your Site

► Getting your site listed will help immensely, but you may also want to promote your site through banner advertising. Targeted banner advertising is one method, but it can get very expensive. One advertising network, **Flycast Network** (www.flycast.com/adlab), offers an inexpensive way to test your ads in a limited run. A cheaper alternative is to participate in a banner swap program. **MSN LinkExchange** (www.linkexchange.com) and **HyperBanner** (www.hyperbanner.com) are two great places to start. Both offer flexible banner exchange programs and huge arrays of promotional services. To learn more about the ins and outs of banner advertising, including useful tips on effective banner design, check out the **Website Promoter Resource Center** (www.wprc.com)

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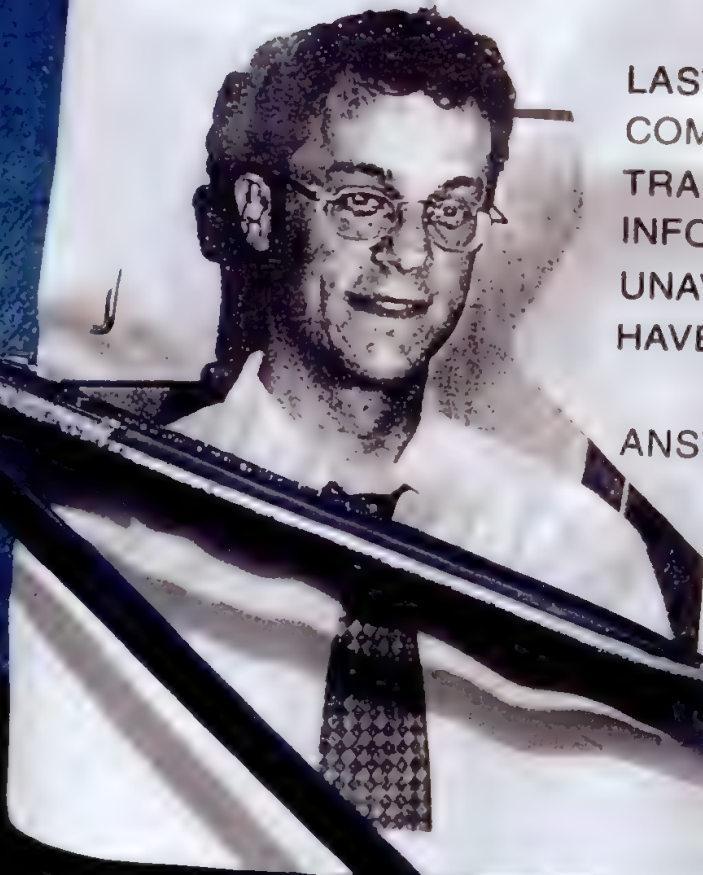
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VERITAS



Athlon vs. PIII at 600 MHz

Which CPU is faster, the AMD Athlon or the Intel Pentium III? PC Labs tests both, as well as a 650-MHz Athlon machine.

By Carol Venezia

So you've already decided: Your new PC must have the fastest processor available. And if you're going to be running Windows 98 in a home or small-office environment, right now, that processor is either an AMD Athlon or an Intel Pentium III.

Both CPUs are available at speeds up to 600 MHz, and in the case of the Athlon, up to 650 MHz. That should be enough to keep any Web surfer, financier, or even low-end Web content creator happy. Add a high-speed cable or DSL modem, and you're off to the races.

Athlon: The New Speed Demon

Going strictly by the numbers, the edge in speed goes to the Athlon. As we found in testing for this story as well as for this issue's cover story ("The Right Speed for You"), the Athlon just squeaked past the PIII on busi-

ness applications, as shown by our ZD Winstone 99 benchmark tests—as well as on some 3-D apps, as shown by our ZD 3D WinMark 99 benchmark tests.

The Athlon's prowess on integer-based code was readily demonstrated on our ZD CPU-Mark 99 tests. Clock for clock (in this case, at 600 MHz; there's currently no PIII/650), the Athlon outperformed the PIII by 28 percent. Part of the reason for this difference is design—the Athlon has microarchitectural advantages over the PIII that translate into higher performance on both integer and floating-point code (for more details, see our cover story).

On the other hand, the results from our 3D GameGauge 2.0 tests were just too close to pick a definitive winner. Since GameGauge includes games coded to take advantage of both AMD's and Intel's specific multimedia instruction sets (3DNow! and SSE, respectively), neither processor enjoyed

any competitive edge during testing.

Beyond Speed

For many consumers who are in the market for fast PCs, there's more to the equation than benchmark test numbers. But if speed is all you care about, the decision is easy: Buy an Athlon machine.

The rest of us (the vast majority, we'd argue) consider many other factors that go beyond the hardware specs—including service and support, ease of use and setup, quality of the software bundle, and warranty, just to name a few. In this roundup, you'll find four very fast PCs, but you'll also find that each has a story.

The Athlon-based Compaq Presario 5861 is a great family entertainment machine, with perks such as a THX-certified speaker system, hooked to a four-channel positional 3-D audio card. The Dell Dimension PIII-based XPS T600 offers the

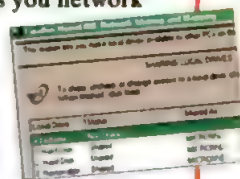
MORE MP3: Creative Labs releases the Nomad Digital Audio Player for music lovers on the go. *Page 49.*



NEWBIE WEB SITES: Even beginners can build impressive Web sites with Trellix Web 2.1. *Page 60.*



HOME SWEET NETWORK: The Farallon HomeLine package lets you network PCs with Macs and share Internet access. *Page 73.*



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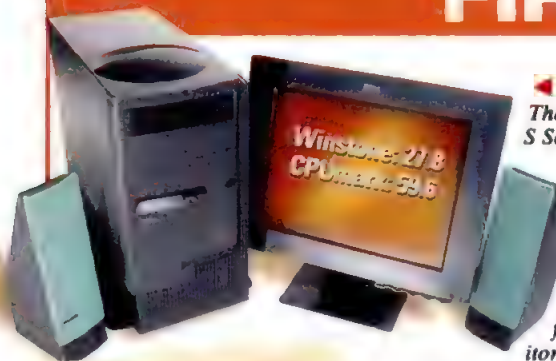
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The IBM Aptiva S Series 860 Athlon machine is the most visually appealing entry—as well as the fastest system here—and it comes ready to be networked in your home. The Quantex SM600 PIII machine is basically just the hardware—its appeal is its price, which is \$300 to \$600 lower than the other PCs in this roundup.

Buying a PC is a very personal decision; what appeals to some may be inconsequential to others. Virtually every PC ven-

dor can give you the hardware that you want, but the intangibles that enhance your computing experience are what make the buying process difficult. But take heart: No matter what type of PC you want, how you want to purchase it, and what types of services you want, there's a vendor with a solution for you.

Compaq Presario 5861

If your idea of the perfect home PC centers around family entertainment, check out the Compaq Presario 5861 (\$2,413 direct). This machine benefits from a fabulous 3-D positional audio system and gains points for ease of use and easy Internet access through the Compaq.net ISP. On the downside, Compaq performed poorly on our most recent Service & Reliability survey (see our July issue, page 183), receiving the lowest possible rating for home desktops. Unlike other Presarios, you cannot buy this model in retail stores; you must purchase it directly from Compaq, via phone or online.

The coolest feature of the Presario 5861 is its butt-kicking sound system. Internally, it's powered by a Diamond Monster Sound MX300 card, which uses Aureal A3D 2.0 technology

to crank out 3-D positional audio on up to four speakers. Outside the box are four speakers, which along with a sizeable subwoofer, make up the Klipsch ProMedia V.2-400 THX-certified multimedia speaker system. The sound package adds \$249 to the price, but if you're serious about PC audio, this 400-watt system (delivered by a five-channel built-in amplifier) will rock your desk—and beyond.

You can use Compaq as your ISP through the company's Compaq.net service, powered by UUNet. Although various plans are available, we found the Yearly Pre-Pay plan to be the most attractive. Just pay \$143.99 up front, and you get one year of unlimited surfing, plus 5MB of personal Web space, one e-mail address, and a personalized start page.

Compaq also scores for ease of use with the Presario 5861 keyboard's quick-launch buttons. You can use them to go online, check your e-mail, conduct a search, go shopping, or even print an active document. The Presario 5861's mini-tower also has USB, FireWire, and joystick ports up front for easy access.

Compaq trails in the standard warranty department compared with its all-direct competitors, backing its Presarios for just one year. You can, however, upgrade the warranty at the time of purchase; an extra \$139 will bump up parts and carry-in labor coverage to three years.

The machine-resident support system for the Presario is excellent. Diagnostic

Compaq Presario 5861
Direct price: \$2,413
with Athlon/600 CPU,
128MB RAM, 13GB hard disk,
Compaq MV920 19-inch monitor.
Compaq Computer Corp., Houston;
800-888-0220
www.compaq.com



SUMMARY OF FEATURES

600-MHz PCs

PC MAGAZINE
SEPT. 2000

	Compaq Presario 5861	Dell Dimension XPS T600	IBM Aptiva S Series 860	Quantex SM600
Direct price (with 128MB RAM)	\$2,413	\$2,678	\$2,598	\$2,099
Processor	Athlon	Pentium III	Athlon	Pentium III
Hard disk capacity	13GB	20GB	20.4GB	18GB
Graphics adapter/ memory	3dfx Voodoo3 3500 / 16MB	Diamond Viper V770 Ultra / 32MB	ELSA Erazor III AGP / 32MB	Creative Labs 3D Blaster RIVA TNT2 / 32MB
19-inch monitor	Compaq MV920	Dell M990	IBM G96	Quantex XP190DF
DVD-ROM drive speed	8X	8X	8X	6X
Extra mass storage	None	Iomega Zip 100MB	None	None
Sound device	Diamond Monster MX300	Creative Labs Sound Blaster Live! Value 512V	Aureal Vortex2 PCI	Aureal Vortex2 PCI
Speakers	Klipsch Pro- Media V.2-400	Altec Lansing ACS-340	Infinity	Altec Lansing ADA-305
Modem	Compaq 56K V.90	U.S. Robotics 56K V.90 WinModem	Rockwell 56K V.90	3Com 56K V.90 PCI
Software included	MS Encarta 99, Money 99, Word 2000, Works 4.5, MGI VideoWave II	MS Office 97 Small Business Edition	Lotus SmartSuite Millennium Edition, Mech- Warrior III	None
Standard warranty on parts/labor	1 year/ 1 year	3 years/ 1 year	1 year/ 1 year	3 years/ 1 year

and support functions include Built-In Technician, which diagnoses problems on the fly; Remote Support, a remote-diagnostic solution using Carbon-Copy; Service Connection, which uses BackWeb technology to push software updates from the Internet to your desktop; and Quick Restore, which lets you return your Presario 5861 to factory-pristine condition.

The company's poor showing on our Service & Reliability survey may make some buyers hesitate. But in general, we were impressed by the Compaq Presario 5861, which has the makings of a great digital home entertainment center.

Dell Dimension XPS T600



What Dell brings to the high-speed PC party with the Dimension XPS T600 Pentium III-based PC (\$2,678 direct) is a stellar combination of one-stop shopping and unsurpassed service and support, particularly online. Add to this a grade of A on our Service & Reliability survey for both home and office desktops and a year of Internet surfing via Dellnet, and you have our Editors' Choice.

Dell's newest offering for its customers is Dellnet, the company's own ISP (via a partnership with UUNet). For an extra \$129 (included in the price above), you get 150 hours per month of Internet surfing for a year. But just in case you don't think that's enough, the company has added a few perks.

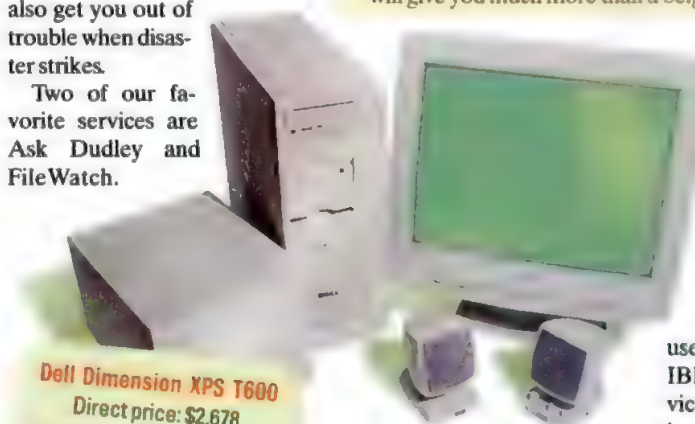
Customers enter Dellnet via their own personalized portal, created for Dell by Snap.com. There each one can set up a free e-mail account, participate in chat sessions, customize news and information feeds, conduct searches, and take advantage of discounts on products and services offered by Dell partners.

On Dellnet, you can also create Web pages through Home-

stead.com, sell that old PC to the highest bidder at Dell-auction.com, take a Kodak tutorial on digital photography, and store up to 20MB of data for free via @Backup. The purpose is to give Dell customers an easy way to get the most out of their new PCs, and if anything goes wrong, you've got one phone number to call to solve your PC problems (800-247-9362).

Dell service and support is tops—and this showed on our most recent Service & Reliability survey, where the company's desktops earned the highest marks for both home and office use. And as you peruse Dell's support offerings, you'll find that there are many services (online and preloaded on Dimension machines) that help you not only maintain your PC's health but also get you out of trouble when disaster strikes.

Two of our favorite services are Ask Dudley and FileWatch.



Dell Dimension XPS T600
Direct price: \$2,678
with Pentium III/600 CPU,
128MB RAM, 20GB hard disk,
Dell M990 19-inch monitor.
Dell Computer Corp.,
Round Rock, TX; 800-388-8542
www.dell.com

The former is a great place to go when you have a problem with or a question about your PC. Just type in your question and click Ask, and you'll get an instant answer. FileWatch is a subscription-based service that notifies you via e-mail when there's a new driver or fix available for your PC, so you can avoid potential problems before they become major issues.

The Dell Dimension XPS

Editors' Choice

• Dell Dimension XPS T600



The good news about the PCs in this roundup is that there isn't a bad deal in the bunch. All have features that will appeal to many buyers, depending on what's important to them when purchasing a PC. And whether you choose an

Athlon or a Pentium III, you'll get all the power you need to surf the Web, figure your taxes, or shoot up the bad guys.

Our Editors' Choice in this roundup, the Pentium III-based Dell Dimension XPS T600 (\$2,678 direct), isn't the winner in the AMD-versus-Intel war—it's a winner in the best-buy-for-the-customer war. We were particularly impressed with this PC because of what Dell has added to it to differentiate from the competition. With features such as Dellnet (Dell's affordable and customizable ISP offering), awesome service and support that earned a grade of A from our readers, and online support offerings that set the pace for the industry, a Dell PC will give you much more than a beige box with a modem.

both home and office PCs. But the machine did have a few problems running some of our GameGauge tests. Like the Presario 5861, this Aptiva cannot be purchased in retail stores; the unit is only available direct from IBM.

Like Dell and Compaq owners, Aptiva owners can use IBM as their ISP, through IBM Internet Connection Services at IBM.net. But the pricing, comparatively, is somewhat high. For individuals, the cost is \$29.95 per month (not included in the above pricing) for 100 hours of access, 12MB of mailbox space, 10MB of Web storage space, and three user IDs. Aptiva owners receive no special discounts, so compared with Compaq and Dell, you're paying two to three times as much—and getting fewer hours online.

On the upside, IBM has a great online program for customers, called IBM Owner Privileges (the service is free for as long as you own your Aptiva). Through this program, you can get discounts on software, accessories, services, and upgrades via IBM's Web site.

T600 is our Editors' Choice because it's not just a beige box full of hardware: It's also a rewarding, hassle-free computing experience backed by industry-leading support.

IBM Aptiva S Series 860

The snazzy black IBM Aptiva S Series 860 (\$2,598 direct with monitor) wins the best-dressed prize in this roundup, along with the performance crown. This 600-MHz Athlon machine posted top scores on both our Winstone and 3D WinMark benchmark tests. And like Dell, IBM earned a grade of A on our most recent Service & Reliability survey for

FIRST LOOKS



IBM Aptiva S Series 860
Direct price: \$2,598
with Athlon/600 CPU,
128MB RAM, 20.4GB hard disk,
IBM G96 19-inch monitor.
IBM Corp., Armonk, NY;
800-426-7235, ext. 4340
www.pc.ibm.com/aptiva

During the Aptiva's warranty period, you get preferred call handling for IBM's HelpCenter technical support. And at IBM's Online Advisory Center, you'll find all kinds of advice including how to keep your Aptiva running well and show your kids how to surf safely.

This Aptiva also comes ready to network, courtesy of an Intel AnyPoint Home Network card (included in the above pricing). All of the software you'll need is preinstalled, making it easy either to plug the Aptiva into an existing phone line network or to make the Aptiva the beginning of a new one.

And to jazz up your new Apti-

va, IBM includes four sets of colored panels for the system's Infinity speakers—black, red, green, and blue. These panels pop on and off, so you can customize your Aptiva to match your mood or your decor.

We were impressed with the IBM Aptiva S Series 860. The machine provides a good combination of fast hardware and a bit of software for each member of your family, along with top-flight service and support.

Quantex SM600

If you buy a Quantex SM600, you'll get a 600-MHz Pentium III-based PC for an incredibly low price. At just \$2,099 (direct), this machine delivers the same level of hardware as the other PCs in this roundup.

What you won't get is any extra software (the system comes with Windows 98 Second Edition only), one-stop ISP shopping, or the level of online and bundled support that you'll get elsewhere. But note that Quantex received a Service &

Reliability grade of A from our readers in the desktop (overall use) category on our most recent survey. Also, Quantex offers the same system including a CD-RW drive, network card, and business software bundle—the SM600 SE—for \$2,399 (direct).

Quantex does have online resources for customers at customers.first@quantex (go to www.quantex.com and click on customers.first banner). Here, you'll have access to a wealth of information, including special deals on hardware and software, access to the Quantex QChat chat room, and technical help and FAQs. What Quantex offers online doesn't come close to the

We were pleased with the hardware inside the SM600; frankly, we were expecting less, given this PC's low price. The SM600 trailed the leaders a bit on hard disk size (18GB rather than 20GB) and DVD-ROM speed (6X rather than 8X), but we're certain that power users will find those components more than sufficient for their needs. Our test machine came with a great set of

Quantex SM600
Direct price: \$2,099
with Pentium III/600 CPU, 128MB RAM, 18GB hard disk, Quantex XP190DF 19-inch monitor.
Quantex Microsystems Inc., Somerset, NJ; 800-346-6572
www.quantex.com



Altec Lansing ADA-305 Dolby ProLogic speakers with a big, powerful subwoofer.

If you want a no-frills, fast machine, the Quantex SM600 is worth a look. **PC**

other vendors in this roundup (at this point the company's more geared toward selling Quantex hardware than anything else), but it's a good start.

PERFORMANCE TESTS



On our benchmark tests, the IBM Aptiva S Series 860, based on the 600-MHz AMD Athlon processor, pulled ahead, posting top scores on both ZD Business Winstone 99 and ZD 3D WinMark 99 by narrow margins.

On the 3D GameGauge 2.0 tests, however, the Aptiva stumbled: It was unable to complete two tests (and we were therefore unable to calculate an average score for this machine), most likely because of issues with the driver for its Elsa Erazor III AGP 32MB graphics board.

The most interesting results we found were on our CPUmark 99 test. The average Athlon score was 28 percent higher than the average Pentium III result. For now, AMD has the fastest processor you can buy.

3D GAMEGAUGE 2.0*

Frames per second
High scores are best.

Compaq Presario 8881 (Athlon)
Dell Dimension XPS T800 (PIII)
IBM Aptiva S Series 860 (Athlon)
Quantex SM600 (PIII)

Average Score	Battlezone II	Descent III	Expendable	Half-Life
65.3	28.0	50.3	64.1	46.1
54.1	33.0	45.2	51.8	37.8
N/A	29.0	47.6	52.4	44.1
52.5	29.0	46.7	48.7	36.9

ZD BENCHMARK TESTS

High scores are best.

Bold type denotes first place.

PC denotes Editors' Choice.

Compaq Presario 8881 (Athlon)
Dell Dimension XPS T800 (PIII)
IBM Aptiva S Series 860 (Athlon)
Quantex SM600 (PIII)

ZD Business Winstone 99	ZD 3D WinMark 99	ZD CPUmark 99
1,024-by-768, true color	1,024-by-768, 16-bit color	1,024-by-768, true color
26.9	1,000	88.3
26.7	1,010	43.9
27.2	1,000	55.5
26.5	990	43.7

* We ran all the 3D GameGauge tests at 1,024-by-768, 16-bit color. N/A—Not applicable. The Aptiva was unable to run the Jane's WW2 Fighters and Unreal tests.



Direction SP E333
January 1999



PowerMate 8000
April 1999



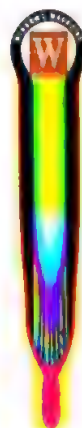
Direction SP E333
December 1998



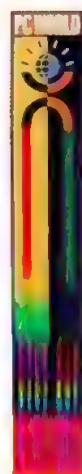
Versa LX
December 1998



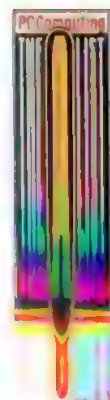
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MobilePro 7500
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Versa 6060
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PowerMate 5000
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Direction SP B400
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Direction SP E300
October 1998



Direction SP E300
September 1998



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Versa 6060
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Versa SX
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PowerMate Enterprise 8000
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Direction SP L333
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Direction SP B450
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Direction SP B400
September 1998



Direction SP B400
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Direction SP B400
September 1998



Direction SP B400
September 1998



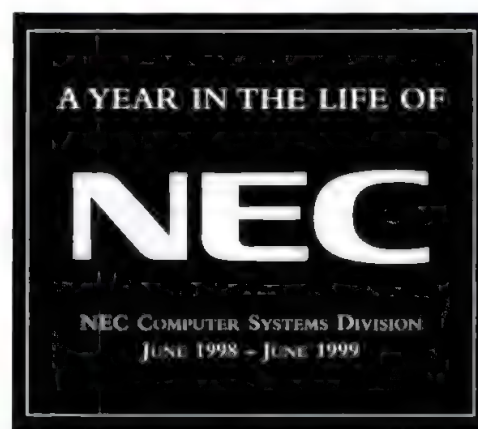
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A Web-Ready Photoshop

With Version 5.5, Photoshop joins the Internet age, making it even more of a must-have program.

By Sally Wiener Grotta

With the release of Photoshop 5.5 (\$610 street, \$199 direct upgrade), Adobe brings its premier professional image-editing program into the Internet era, by turning this new release into an integrated suite that includes ImageReady 2.0. The new features are welcome, evolutionary additions, but the smooth workflow between the two programs and the new focus on Web graphics is really what sets this version of Photoshop apart.

Preparing an image for the Web using Photoshop 5.5 offers few distractions. Photoshop's and ImageReady's interfaces are very similar, with most palettes nearly identical. If you know either program, you'll quickly adjust to the other.

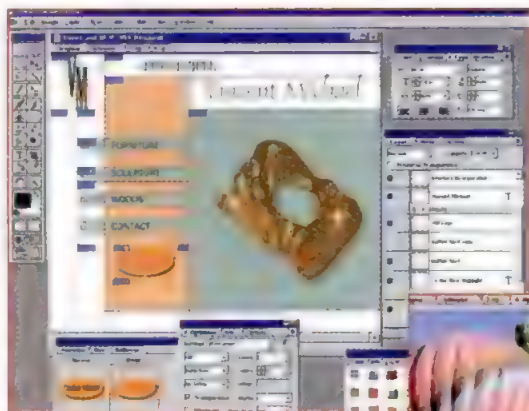
A Jump To icon in each application sends the current picture to the other program, with all layers, layer effects, History palettes, and other attributes intact (although ImageReady's new Gradient and Pattern layer effects aren't editable in Photoshop). In fact, you can add a Jump To command to any graphics program, but if the other program doesn't support and edit this suite's native PSD file format, the "foreign" application will not offer the same data and controls.

Create Web Images

Images can be optimized for the Web in either ImageReady or Photoshop, using a wide variety of user-definable variables. This is done through the Save for Web dialog in Photoshop and as part of the workspace in ImageReady.

GIF, JPEG, PNG8, and PNG24 file formats all have a

full range of parameters, so you can view how file size, compression, number of colors, download times, and other variables affect image quality. Using the color table options, you can add or eliminate colors, select Web-safe colors, shift non-Web-safe colors, and so on. You can preview images according to Mac or Windows colors or in different browsers. User-defined optimizing settings and color tables can be saved for future use.



▲ WEB TOOLS: With an interface very similar to Photoshop's, ImageReady offers image slicing and mapping, rollover buttons, and other Web-centric tools.

Other New Tools

The handful of new non-Web-oriented tools in Photoshop are extensions of previous Adobe functions. Taking the concept of color tolerance further and cutting out mouse clicks, Photoshop now has Magic Eraser and Background Eraser, both of which easily remove clicked-on colors and set the selected area to transparency.

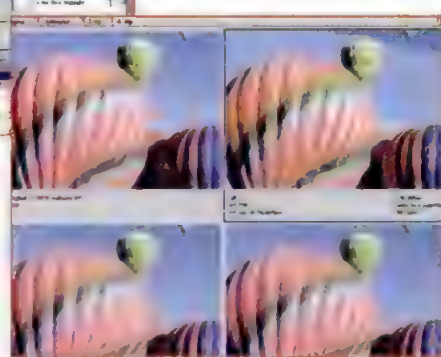
Similarly, the Extract Image command creates a mask based on edge detection. Extract Image is not effortless, but for certain types of masks, such as those with flyaway hair, it will save considerable time. The new Art History Brush recreates a former state in the History

palette, using artistic strokes.

New automated tasks in Photoshop create school-picture-like photo packages (the same picture in different sizes on a single page) and Web picture galleries (with title pages of thumbnails linked to full-size pictures). Although file names can now be set as captions for the improved contact sheets as well as the Web gallery, no custom titling is possible.

ImageReady has always had a clear focus: creating Web-ready images for export to your HTML editor. A new Update HTML command does a slick two-click update that exports ImageReady

or Photoshop image edits to any HTML authoring program, replacing the original image embedded in your Web page with the new version.



▲ READY, SET, GO: Photoshop's superb Save for Web dialog provides a visual comparison of different optimization settings.

More Key Frames

Other improvements in ImageReady 2.0 include new Java script rollovers that are simple to create, using separate layers for each state. Similarly, secondary effects (such as animations or the display of an image) can be triggered by any rollover state. But with the Layers palette being used for so many different functions (including animation frames), Adobe needs to create a hierarchical organization to make managing

and editing your pictures easier.

Images can now be automatically or manually sliced with precision for HTML tables. Slices can be assigned URLs or alternative nongraphical displays and can be optimized individually. Linking separate but similar slices streamlines workflow by applying edits to the entire group (such as a font or shadow change). To eliminate undesirable borderlines effectively, you can apply the same dither pattern to linked slices.

Though ImageReady's animations tend to be simple ones, Version 2.0 also imports QuickTime-compatible movie formats such as AVI, FLIC, and MOV. This is for editing the individual frames or simplifying them into GIF animations rather than placing them on your Web document, though.

Photoshop 5.5 supports the new Acrobat 4.0 PDF 1.3 file format, with its PostScript 3 printing and embedded ICC profiles and fonts. But because of a CD defect, we were unable to install ICC profiles to test this. Any reader whose Photoshop CD fails to install should contact Adobe at 206-675-6303 to ask for a new copy.

Photoshop remains a superb image-editing program for output to print. Now you can apply the same familiar tools, power, and sophistication to your Web-destined images. Adobe Photoshop 5.5 is a must-get upgrade for graphics professionals.

Adobe Photoshop 5.5. Street price: \$610; upgrade for Photoshop 5.0 and ImageReady 1.0 users, \$129 direct; upgrade for users of earlier versions, \$199 direct. Adobe Systems Inc., San Jose, CA; 800-492-3623; www.adobe.com.



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Traveling Tunes

Creative Labs' new MP3 player provides an elegant, portable MP3 listening experience.

By S. Jae Yang

Smaller than portable CD players and MD (MiniDisc) players, MP3 players could become the portable digital audio devices of the Internet age. Now Creative Labs has introduced its MP3 player, the Creative Nomad Digital Audio Player, to compete with the Diamond Rio PMP300 Portable Music Player (for a review of the Rio, see First Looks, January 19).

The 32MB version of Nomad (\$169.99 direct) can hold up to 30 minutes of near-CD-quality music at the 128-Kbps encoding format. You can double that capacity by adding a 32MB flash memory cartridge (\$89.99 direct) or buying the 64MB Nomad (\$249.99 direct), which includes the cartridge.

With no mechanical parts or optical media, the Nomad fits into a shirt pocket. In a compact, retro-style magnesium case, the Nomad includes an FM receiver and a voice recorder—components that the Rio doesn't have.

On the Nomad's elegant interface, the round LCD shows you everything you need to know at a glance. The control buttons follow the convention of CD players, so operations will be intuitive for most users. There is also a hold switch, which can disable all control buttons.

Much like MD players, MP3 players let you create a collection of your favorite songs. Using Music Match's bundled Creative Audio Center software, you can convert the tracks

from your CDs into MP3 files—a process called *ripping*. Then, via the bundled docking station, you can connect the Nomad to a PC via a parallel port and download the ripped MP3 music to the Nomad. (A USB version of the Nomad would be welcome.)

The Creative Audio Center software can rip music at various encoding rates—from 64 Kbps to 160 Kbps. The higher encoding rate, of course, requires more data space. Using the docking station and the Nomad's Audio Manager software, you can also transfer MP3 files that you've downloaded from the Internet.

On our tests, Nomad produced acceptable audio at 64 Kbps; we had to listen carefully to distinguish the 128-Kbps playback from CD audio. To trained ears, however, playback with the Nomad at 128 Kbps was slightly distorted, with a loss of dynamic range.

MP3 brings unprecedented



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freedom and portability to music lovers on the go, with a trade-off in audio quality that's undetectable to most. The compact and elegant Creative Nomad Digital Audio Player is a prototypical MP3 digital audio device integrated with the Internet.

Creative Nomad Digital Audio Player. Direct prices: Base model with 32MB internal flash memory, \$169.99; 32MB flash memory upgrade, \$89.99; 64MB model, \$249.99. Creative Labs Inc., Milpitas, CA; 408-428-6600; www.nomadworld.com.

Bargain 3-D Animation

Version 4 of Poser is an indispensable tool for computer-generated animation—and a great deal.

By Luisa Simone

Over the years, MetaCreations Corp.'s Poser has been transformed from a simple modeling tool for 2-D artists to a full-feature 3-D character-animation program. The latest release, Version 4 (\$249 list), takes one more step in that direction by providing more malleable figures, artistic rendering modes, and tighter integration with 3-D modeling programs.

Previous versions of Poser let you change a figure's skin color and choose a new hairstyle. But there was no way to create ethnically authentic features within the program. Poser 4 changes all that with easy-to-use parameter dials that can morph a whole range of

facial traits, including the shape of a face, the jut of a jaw, and the angle of a nose.

A new class of objects, called *deformers*, let you create distortions within other objects. Though shown in the workspace as real objects—specifically, a magnet and a wave—deformers are invisible at render time: Only the effects they create are visible. So you can, for example, have wind

ripple a character's hair.

Deformers have several built-in controls, including parameter dials and the ability to define a zone in which the effect will take place. But we produced the best results by using the deformers in conjunction with custom polygon groups, another new feature.

In response to the number-one user request, Poser 4 offers interchangeable 3-D clothing for the otherwise nude figures. We discovered that because of differences in the underlying geometry, you can't make the clothing

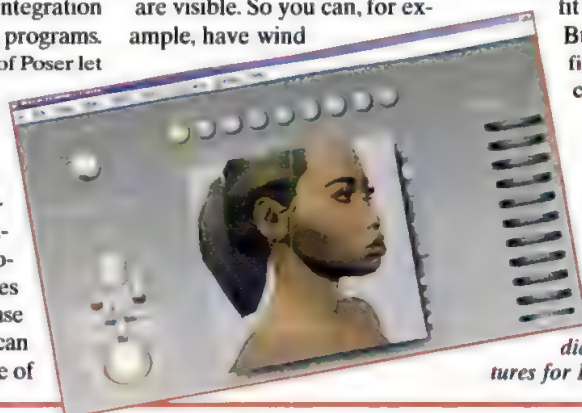
fit modified figures. But for a standard figure, the clothing conforms properly.

Importing 3-D models created in other programs is easier than ever

now, because Poser 4 has an integrated hierarchy editor for imported geometry. And a number of new features, including better lighting controls and support of transparency and reflection maps, produce much more realistic renderings. But if realism is not your thing, you'll love the new Design Sketcher, which renders a figure or an animation in an artistic style (charcoal or colored pencil, for example) with spectacular results.

Poser 4 isn't perfect. It still doesn't offer collision detection or true ray-traced shadows and reflections. But the software is an amazing bargain and an indispensable tool for anyone doing computer-generated character animation.

Poser 4. List price: \$249; upgrade, \$129. Requires: 32MB RAM; 240MB hard disk space; Windows 95, 98, or NT 4.0 with service pack 3 or later. MetaCreations Corp., Carpinteria, CA; 800-846-0111; www.metacreations.com.



◀ **FACE VALUE:** A new set of parameter dials (right) let you dial in ethnic features for Poser 4 figures.



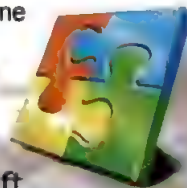
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5-Pound Projectors

Take that presentation on the road with the Compaq MP1600 or the Lightware Scout.

By Alfred Poor

We've all become a bit jaded by claims of faster, brighter, and less expensive, but now the vanguard of a whole new breed of portable projectors has arrived. At just about 5 pounds each, these machines weigh less than some notebook computers.

Significant problems are involved, however, in designing these bantamweights. The lamp and display engine must be crammed into close quarters, which makes cooling difficult, and lenses along the light paths must be made small, which leads to any defects being more visible in the projected image.

Though many manufacturers have announced lightweight projectors, the first was from Lightware, the Lightware Scout (\$2,995 direct). Compaq was close behind with its MP1600 Microportable Projector (\$4,500 direct). The 50 percent price jump is just one sign of the companies' different design philosophies.

Compaq MP1600 Microportable Projector

Most projectors lie flat on the table, but the 4.2-pound Compaq MP1600 Microportable Projector stands on one long edge of its case. Turn the unit on and you'll see a native XGA (1,024 by 768 pixels) resolution image, though the device can scale signals from VGA (640 by

BALANCING ACT: A rotating stand at the MP1600's base provides extra stability.



480) to SXGA (1,200 by 1,024). You won't see the "screen door" effect of individual pixels be-

cause this unit relies on Digital Light Processing (DLP) micromirror technology from Texas Instruments.

Our tests indicate that the MP1600 600 ANSI lumens rating is accurate; most projectors score lower than rated, but this unit scored 598 lumens. The Brightness Variance score, 1.11, was very good, and the image on the screen had no obvious hot spots or shadows. The contrast ratio, at 205:1, was typically excellent for a DLP projector.

All in all, the projected images were good but not outstanding. The auto-synchronization was excellent, producing images with no pixel jitter and only a minor timing tweak required. The projector also has a Digital Flat Panel (DFP) connection. Color tracking and color ramps were good, and we observed no ghosting.

On the downside, there appeared to be some refraction or other artifacts from the optical system that blurred the image—especially in the corners. The projector was strong with light shades of gray but weak on dark shades, and in general the colors

didn't have the punch of those of other DLP projectors. When playing video through the optional video adapter (\$249 direct), we noticed pronounced cross-hatch artifacts; these may be caused by flaws in the video decoding.

The projector comes with a soft carrying case and cables.

Speakers are not included.

The MP1600 has high resolution and a bright image but few

frills—and it carries a much higher price than its Lightware competitor.

Compaq MP1600 Microportable Projector. Direct price: \$4,500. Compaq Computer Corp., Houston; 800-345-1518; www.compaq.com.

Lightware Scout

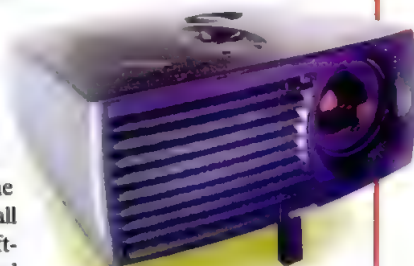
Technically, the Lightware Scout does not aim as high as the Compaq model, but the Scout pours on the value with all its additional features. The soft-sided case holds the 5.3-pound projector, but it also has a padded compartment for a notebook. The Scout includes a small remote control, two-speaker sound (with synthesized surround-sound effects), and Plug and Play support including an INF configuration file.

The company's success comes from taking less expensive technology and building around it. Where most projectors use DLP chips or triads of LCD panels, the Scout uses a single 1.6-inch polysilicon active-matrix panel. The native resolution is just SVGA (800 by 600 pixels), though the unit can scale images from VGA to XGA.

On our tests, the Scout scored just 331 lumens, which is slightly low for its 500 ANSI lumen rating. The contrast ratio was adequate, but unlike the Compaq projector, the Scout had pronounced hot spots at the center and edges of the screen.

No control was supplied to

help improve the projector's display of dark gray shades, though we did use the unit's bright-room setting for maximum brightness. The Scout was excellent with light



GREAT VALUE: The 5.3-pound Scout is an affordable projector with many additional features.

shades of gray, and color tracking was also good. Colors were vivid and images were steady without pixel jitter or flicker.

The image had some problems with focus, especially in the upper left corner, and there was some noticeable horizontal ghosting. We also saw pronounced streaking for bright objects on a black background. But video was fine, and facial tones had no noticeable artifacts.

If you want a lightweight projector with good-enough image quality and all the trimmings at a price lower than those of many notebook computers, the Scout could be your solution.

Lightware Scout. Direct price: \$2,995. Lightware Inc., Beaverton, OR; 800-211-9001; www.lightware.com.

PERFORMANCE TESTS

5-Pound Projectors

The Lumens measurement gauges the brightness of each unit. The Contrast Ratio indicates the difference between white and black in the image. The Brightness Variance indicates the difference between the brightest and dimmest measured points on the screen when projecting an all-white image (1.00 is a perfect score).

▲ High scores are best.

▼ Low scores are best.

Compaq MP1600

Lightware Scout

Lumens ▲

598

331

Contrast Ratio ▲

205:1

84:1

Brightness Variance ▼

1.11

1.53

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The Instant-Messaging Wars Commence

With the introduction of MSN Messenger Service, Microsoft takes aim at America Online's instant-messaging protocol.

By Jim Lynch

Once, e-mail was regarded as the killer application on the Internet. Now e-mail is taking a back seat to its younger sibling—instant messaging. IM started out on proprietary services AOL and CompuServe and then migrated to the Internet in the form of the ever-popular ICQ program (for our most recent First Looks review of ICQ, see “Not Just Chat Anymore,” April 20).

AOL soon devised its own IM client—AOL Instant Messenger (AIM). AOL bundled AIM with Netscape Navigator software and surpassed ICQ in popularity. That has made AIM an attractive target for other companies seeking access to its 40-million-plus user base.

Enter the wanna-be online giant, Microsoft, which has just released MSN Messenger Service, its own IM client. Not content with having just an IM client of its own, Microsoft has gone after AIM's audience by making sure that anyone using MSN Messenger can also IM their associates who use AIM. Combatants such as Yahoo! are also beginning to enter the fray.

Who will be the winner in all of this? Consumers. We'll have more choices, and maybe the beginning of a unified instant-messaging protocol that will let us use IM the same way that we use e-mail.

AOL Instant Messenger 2.0

AOL recently released Version 2.0 of its popular Instant Messenger, bulking it up with enhanced features and therefore making it more of a desktop portal. Among AIM's new features are a Web search mechanism, yellow and white pages, file transfers, an enhanced people finder, public and

private chat rooms, and a community directory.

AOL has kept AIM in the easy-to-use category, avoiding the interface overload of ICQ. You perform Web searches through AOL's Netfind search engine by typing search terms into the AIM search box. As with ICQ and its search mechanism, this has the effect of turning AIM into a quick-search utility.

RAM; 5MB hard disk space; Windows 95, 98, or NT 4.0. America Online Inc., Dulles, VA; 703-265-1000; www.aol.com.

MSN Messenger Service

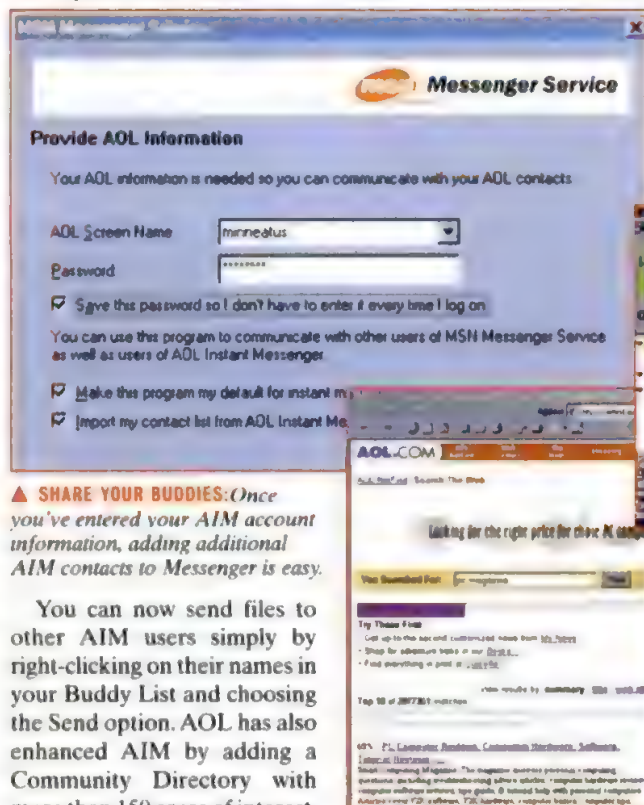
Microsoft fired its opening salvo in the IM wars with MSN Messenger Service and aimed squarely at the most popular IM product on the market—AOL

fer, to-do lists, or news feeds.

Those with Hotmail accounts can use MSN Messenger immediately. The downside is that those without Hotmail accounts will first have to register with Hotmail in order to use MSN Messenger. The current registration procedure takes the user away from the client and into a Hotmail environment, which is annoying and potentially confusing to novice users.

When you first install MSN Messenger (only a 320K download), it automatically checks whether AOL Instant Messenger is installed. If this is the case, you'll be asked whether you want to add your AIM contacts to MSN Messenger. If you choose Yes, you'll be prompted for your AIM screen name and password. You can easily add AIM contacts by clicking on the Add tab.

MSN Messenger Service is a good entry into this space. The AIM functionality is, we hope, a first step toward a unified instant-messaging protocol that will



▲ SHARE YOUR BUDDIES: Once you've entered your AIM account information, adding additional AIM contacts to Messenger is easy.

You can now send files to other AIM users simply by right-clicking on their names in your Buddy List and choosing the Send option. AOL has also enhanced AIM by adding a Community Directory with more than 150 areas of interest.

AOL is trying to maintain its lead in the IM space by bundling compelling new features into AIM but also keeping the product easy to use. AOL is still ahead, but staying that way is going to get more difficult over time, especially since other instant-messaging products such as MSN Messenger are beginning to co-opt the AIM protocol.

AOL Instant Messenger 2.0. Price: Free download. Requires: 8MB

▲ FIND IT OUT: AIM now has a handy Web search box built right into its interface.

Instant Messenger. Microsoft adds value to MSN Messenger by letting Messenger users access anyone who is using AOL Instant Messenger.

Aside from a Web search, you won't find AIM 2.0's or ICQ's bells and whistles in MSN Messenger. That's not necessarily bad, especially if you don't need features such as file trans-

fer, to-do lists, or news feeds. The way we send instant messages; the client shouldn't matter. Microsoft's decision to link the two IM clients, though self-serving, is a harbinger of good things to come for consumers.

MSN Messenger Service. Price: Free download. Requires: 8MB RAM; 3MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. Microsoft Corp., Redmond, WA; 800-426-9400; <http://messenger.msn.com>.

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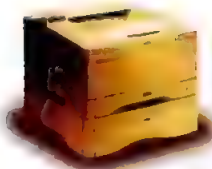
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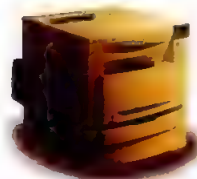
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*Quoted lease payments based on average base unit reseller price as of February 1999 and a 36-month business lease with no down payment required. Lease payments apply to single units with minimum transaction size of \$1,500. Not all products will meet minimum transaction size on single units. Terms contingent upon credit approval and product availability. Rates and promotion are subject to change without notice. Taxes not included. Units above are: HP LaserJet 5000GN, HP LaserJet 8100N, HP Color LaserJet 4500DN, HP Color LaserJet 8500DN. © 1999 Hewlett-Packard Company



Generous Digital Displays

We review two 18-inch digital LCD monitors from Princeton Graphics Systems and ViewSonic.

By Alfred Poor

There was a time when you had to choose between the crisp detail of a digital LCD desktop monitor and the expansive display of a large CRT. If you're not the type to accept compromise—and if you have the budget to support your tastes—then Princeton Graphics Systems and ViewSonic have 18-inch LCD monitors that may have the big view you're looking for.

Aside from a difference in price (the ViewSonic VPD180's street price of \$3,880 is almost a third more than the Princeton DPP800's street price of \$3,000), the two monitors are remarkably similar. Both support Digital Flat Panel (DFP) interface, which is the precursor to the recently adopted Digital Visual Interface (DVI) developed by the Digital Display Working Group. (A simple adapter will make DFP devices compatible with DVI.)

The digital interface is an important advantage because the display informa-

tion remains in digital format from the time it is created until the time it hits the screen. Other LCD monitors rely on a standard analog RGB (red, green, blue) interface, which is the same used by CRT (cathode ray tube) monitors. An analog interface requires that the signal be converted from digital to analog at the graphics card and then back to digital again in the LCD monitor. This double conversion often results in degraded image quality. Both and DFP and DVI specifications rely on PanelLink technology, developed by Silicon Image.

Matching Monitors

Each monitor has a SXGA 18-inch diagonal active-matrix LCD panel, a brightness control, and a powered USB hub (though neither can be controlled via the USB connection). Both monitors come with a typical pedestal base, but they can also be mounted on a wall.

The two monitors had the same image quality flaws, which is strong evidence of their common backgrounds. Each contains the same LCD panel from Sharp; with its own proprietary electronics.

Each monitor came with an AGP version of the ATI Xpert LCD graphics card, which offers both traditional analog RGB and the newer digital DFP connections. We used software from DisplayMate Technologies (www.displaymate.com) to assess the image quality, and found that the two monitors were nearly identical.

Image Quality

The images were perfectly centered and filled the screen—one

of the advantages you'd expect from a digital interface panel, and there was not a hint of pixel swim or jitter. Color reproduction was good; the monitors showed no problems with color tracking on the gray scales. Focus was perfect, right down to the subpixel level—another advantage of a digital display.

On the downside, both monitors were weak on displaying shades at the extreme ends of the gray scale, and the limited range of the brightness control had little effect on this problem. As a result, each monitor lost details in areas of dark shadows or bright highlights. Perhaps more serious for graphics applications was that both monitors showed conspicuous discontinuities towards the dark end of color ramps. These appeared as pronounced bands on what should have been smoothly gradated color ranges.

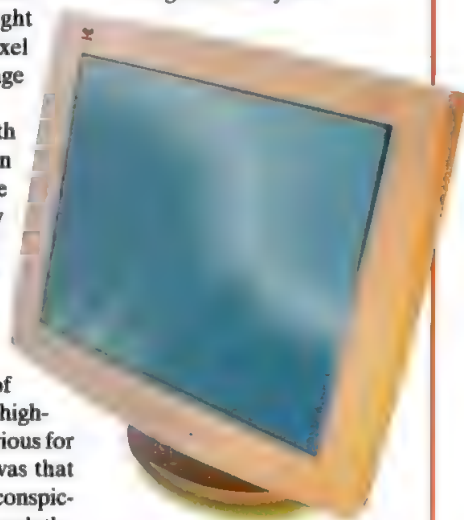
As can be expected, both monitors are at their best when running at their native resolution of 1,280 by 1,024 pixels. They are both capable of scaling up lower resolution images, but with some loss of image quality. At 1,024 by 768 (XGA), images were not in proper proportion because the SXGA resolution is a 5:4 aspect ratio, while XGA and other standard formats have a 4:3 aspect ratio. Furthermore, the scaling engine does not always do a great job on text.

By All Appearances

There are few differences among the monitors' physical features. Perhaps the most significant divergence is that the Princeton monitor has attractive covers in the back that hide the cables, and connecting the cables to their ports is much easier than on the ViewSonic unit.

Princeton backs its display with a three-year warranty on the whole unit, including the

backlight, plus one year of 48-hour quick-exchange coverage. ViewSonic also provides a three-year warranty and one year of express-exchange coverage, but only covers the backlight for one year.

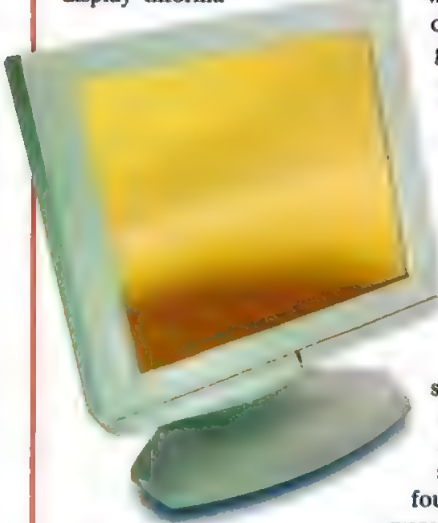


▲ THE BIG PICTURE: Like the Princeton monitor, the ViewSonic VPD180 offers excellent image quality on an 18-inch screen.

The Princeton monitor clearly has the advantage over the ViewSonic model. The DPP800 is easier to set up, has three-times the warranty on the backlight, and costs close to \$1,000 less in the bargain. Calling a \$3,000 monitor a bargain is difficult, however, in these days of \$500 PCs. If you want a large, digital LCD for \$3,000, you could buy two 15-inch LCD monitors instead—including graphics cards—and still have enough left over to buy a substantial computer system. Without a doubt these displays look great, but they make sense only if you need the large display area and LCD image quality in a single unit.

Princeton DPP800. Street price: \$3,000. Princeton Graphics Systems Inc., Santa Ana, CA; 800-747-6249; www.princetongraphics.com.

ViewSonic VPD180. Street price: \$3,880. ViewSonic Corp., Walnut, CA; 800-888-8583; www.viewsonic.com.



▲ BETTER BARGAIN: The Princeton DPP800 offers a better warranty and a lower cost than the ViewSonic model.

Security with USB Ease

The E-Z Lock Smart PC Security with USB uses the iKey token for connection via a USB port.

By Stephen W. Plain

User authentication with smart cards continues to grow in popularity, but card readers add cost and hassle to such solutions. The E-Z Lock Smart PC Security with USB package (\$200 street, discounts for volume purchases) solves that problem by providing a hardware token that uses a standard USB port instead of a card reader. Though a bit costly for smaller businesses, E-Z Lock makes sense for organizations that need absolute authentication and for environments where several users share the same machine but need different privileges.

This security package uses the iKey token from Rainbow Technologies (www.rainbow.com). The tiny device measures only 2.3 by 0.6 by 0.3 inches and has a hole on one end for attachment to a key ring. Inside the iKey is 8K of EEPROM (electrically erasable programmable read-only memory) to save user-personalization settings.

To make a connection to the USB port easier with all types of systems, the company provides either an 18-inch or a 6-inch extension cable free of charge. The bundle also includes a CD for the software components.

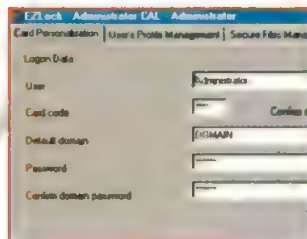
The iKey token can work with many different software packages, but E-Z Lock provides an easy way to implement an authentication solution that offers user-, station-, and file-level security. The tokens and software installations are clearly divided into administration and user configurations.

To log on, users insert the iKey token, then enter a four-digit PIN. Although this is a short password, the token is locked after the third incorrect PIN entry. Each token can be configured to log on to a particular network domain, and optionally, to

let a user log on to additional ones manually.

In addition to providing basic log-on security, E-Z Lock lets an administrator restrict access to particular files and select those that should be secured to the token. This feature is helpful, though it lacks the ability to define secured folders. For this, you should still turn to standard domain security.

The Administrator module also lets you define user profiles that can include an expiration date, a prevented file list, a log-in domain, and an option to secure the user's workstation with a screensaver. An administrator



▲ CHANGE YOUR OPTIONS: The E-Z Lock Administrator module provides access to enterprise security options through a compact interface.

can also unlock workstations for users who accidentally leave their iKeys at home.

A simple application in the Control Panel lets an administrator set up a workstation to work with one iKey per session or many iKeys for situations in

which users share a computer. This utility can also lock the floppy disk drive, DOS sessions, the Registry, F5 and F8 keys at boot-up, and network browsing.

The system worked well on our test LAN, installing quickly with a wizard-driven setup program.

Aside from the USB port location issue, E-Z Lock is a very practical token/password-based security solution.

E-Z Lock Smart PC Security with USB. Street price: \$200 (discounts for volume purchases). Requires: 32MB RAM; 10MB hard disk space; Windows 95, 98, or NT 4.0. E-Z Lock PC Inc., Westmount, Quebec; 888-931-9502; www.ezlock.com.

Upload Web Sites Easily

Even Internet newbies can build and export complex Web sites easily with Trellix Web 2.1.

By Edward Mendelson

With Trellix Web 2.1, even those who know very little about Web programming can build complex, sophisticated Web sites and upload them to a server—automatically. The utility can be downloaded from Trellix's Web site (\$69 direct) and used to upload sites to any ISP, or it can be downloaded free from Interland, Interliant Sage Networks, or Prodigy Internet in special versions that upload only to those networks.

Trellix Web ships with four basic templates for personal and business Web sites, plus 18 graphics design themes that can be applied to any Web site built in the program. Pages are created in a word processor-like interface.

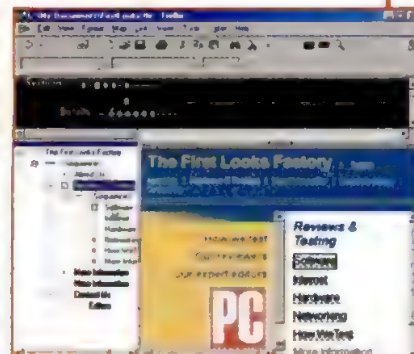
Trellix can't open existing documents and convert them into Web pages, though text and graphics can be pasted from other applications via the clip-

board. As with Microsoft FrontPage and NetObjects Fusion, Trellix Web lets you switch between graphics themes with a few mouse clicks.

Also like Fusion, Trellix creates pages in a proprietary format and exports HTML code only when you preview or upload your site. (Most other site editors create pages directly in HTML.) Some HTML features are implemented awkwardly. For example, when a visitor to a Trellix-created site clicks on links in one frame to change the contents of another frame, the frame containing the links disappears and then reloads again.

The interface combines technical wizardry with annoying inconveniences. The wizardry includes a feature that instantly changes the titles and headers of pages in your document when you change those pages' names in the links and other navigation tools in the page you're current-

ly working on. Among the annoyances are dialog boxes that make fine adjustments to graphics but don't display the changes in real time, so you have to close and reopen the dialog until you get the design you want. Advanced users will prefer a program originally designed as a Web site editor, but Trellix Web



▲ SEE YOUR SITE: Trellix's outline view (on the left) and site map (toward the top).

2.1 lets beginners produce impressive results at low or no cost. **Trellix Web 2.1.** Direct price: \$69. Requires: 24MB RAM (32MB for Windows NT); 28MB hard disk space; Windows 95, 98, or NT 4.0. Trellix Corp., Waltham, MA; 781-788-9400; www.trellix.com.

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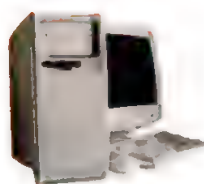
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Graphics	8MB nVidia AGP graphics	8MB nVidia AGP graphics	16MB nVidia AGP graphics
Sound System	Wavetable sound	Wavetable sound and stereo speakers	Wavetable sound and stereo speakers
Monitor	15" Micron 500Cx (13.9" display)	17" Micron 700Cx (15.9" display)	17" Micron 700Cx (15.9" display)
Modem	3Com® US Robotics V.90 Winmodem	3Com US Robotics V.90 Winmodem	3Com US Robotics V.90 Winmodem
Micron University	1-year FREE* training at Micron U. online	1-year FREE* training at Micron U. online	1-year FREE* training at Micron U. online
On-site Warranty	1-year on-site limited warranty	1-year on-site limited warranty	1-year on-site limited warranty
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A Digital Camera for Pros

The Eastman Kodak DCS 620 handles like the favorite film camera of many pro photographers.

By Daniel Grotta and Sally Wiener Grotta

Why buy the Kodak DCS 620 digital camera for \$16,000 (list) when you'd get about the same resolution from the newest generation of \$600-to-\$1,000 2-megapixel digital cameras? That's a no-brainer for serious photographers: The DCS 620 is the first digital camera that works and shoots like a Nikon F5 35-mm film camera, the quintessential system of many pros.

The DCS 620 is a specially modified Nikon F5 camera body wedded with Kodak's advanced digital technology. Although much heavier and larger than entry-level 2-megapixel digital cameras, the DCS 620 is about the same size and weight as a conventional F5 with an extended motor drive and battery compartment. The DCS 620 can accommodate almost all Nikon F-series accessories: lenses, filters, viewfinders, and so on.

What makes the DCS 620 almost irresistible is that it's as fast and familiar to operate as the film-based F5. All the operating controls—auto-bracketing, voice annotation, mirror lockup, burst mode, and multiple metering options—are the same. And in burst mode, the DCS 620's built-in 64MB buffer lets you shoot at the rate of 3.7 frames per second for up to 12 frames—faster than any digital camera on the market. With a handful of high-density Type I, II, or III PC Cards or drives (as well as CompactFlash or SmartMedia cards with adapters), you can record as many images as you would with dozens of standard 36-exposure rolls of film.

The DCS 620 has the unmistakable look and feel of a precision instrument. The camera in-

corporates both an LCD viewfinder and a built-in histogram, which lets you assess how good a just-shot image is. If the image is too dark, or light or if some of the colors are washed out, you can instantly change the settings or the lighting and reshoot.

Each raw image file is about 1.8MB and can be transferred to the PC via the DCS 620's built-in FireWire interface or with a card reader. But image files are saved in a proprietary format that can be opened only via Eastman Kodak's Twain driver.

When decompressed, image files occupy 5.7MB. With the ad-

dition of an anti-aliasing and infrared coating right on the CCD, colors are more accurate and precise than those of previous models. The trade-off is a slight image softness, which can be virtually eliminated by applying a sharpen filter during acquisition. When combined with such advantages as 36-bit capture and superb Nikon optics, the DCS 620's images are superior to those of 2-megapixel digital cameras.

Despite the camera's price, Kodak can't keep up with demand for the DCS 620. Try one for an hour and you'll want to

► PRECISION: The DCS 620 works and shoots like a high-end film camera.



keep it for a lifetime.

Eastman Kodak DCS 620. List price: \$16,000 (without lens, media, or batteries). Eastman Kodak Co., Rochester, NY; 800-235-6325; www.kodak.com/go/professional.

Scanning for Film

The Polaroid SprintScan 4000 film scanner is fast, effective, and affordable.

By Daniel Grotta and Sally Wiener Grotta

Despite dramatic improvements in digital photography, film is still preferred by many photographers. For them, the Polaroid SprintScan 4000 (\$2,000 street) combines the highest resolution

comparison, the top resolution of the Nikon SuperCoolScan is 2,700 by 2,700 ppi, with a dynamic range of 3.2.

Matte-black and compact, the SprintScan comes with a SCSI-2 interface, a cable, a controller board, and AdvanSys's Super SCSI setup utilities. Also included are two carriers for 35-mm strips and slides; an optional APS film adapter is available.

The unit also ships with a quick-start guide and a single page with instructions for installing under Windows NT. The main documentation is a 74-page PDF file.

Though useful for novices, the documentation lacks detailed explanations and scan tips for pros.

Setup and installation are relatively simple, so long as you follow the recommended sequence of events. For instance, you must insert the film carrier after (not before) the driver loads, or the computer "loses" the SCSI connection.

Although the Mac version

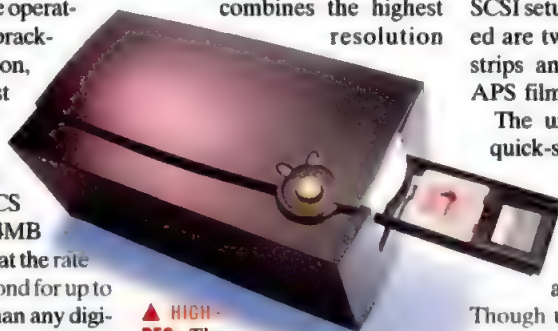
can be installed as a Photoshop plug-in, the PC version is not Twain-compliant, so you can't scan directly into any application. Also, no provisions are supplied for creating scripts, saving images in 12-bit color, or preserving customized settings as default values.

Scanning with the SprintScan is fast and easy. The Polaroid Insight interface is intuitive and offers an impressive variety of manual and automatic tools.

The SprintScan took only 20.4 seconds to scan a 12.8MB slide. But this blazing speed is somewhat tempered by a 49.5-second auto-calibration routine and by the time needed to name and save a file and then open it in an application. Image quality is excellent and holds up even when magnified. Colors are accurate and tonality is very good.

Though the Polaroid SprintScan 4000 has occasional limitations, its image quality is superb. The scanner leapfrogs over the competition in price, ease of use, and most important, high-resolution scans.

Polaroid SprintScan 4000. Street price: \$2,000. Polaroid Corp., Wayland, MA; 800-343-5000; www.polaroid.com.



▲ HIGH-RES: The SprintScan beats the competition in image quality.

in a desktop film scanner with fast performance, excellent image quality, and a remarkably easy-to-use interface.

The SprintScan is a 36-bit film scanner with an optical resolution of 4,000 by 4,000 ppi and dynamic range of 3.4. By com-



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Voice Recording to Go

Dictate or record reminders on the go with the L&H Voice Xpress Mobile Professional bundle.

By Greg Alwang

For those who need to record on the run, the L&H Voice Xpress Mobile Professional package (\$229.99 list) provides you with what you need to record notes and dictation and transcribe them into text when you return to your PC. The bundle includes L&H Voice Xpress Professional 4.0 and the Olympus DS-150 digital voice recorder, which runs on two triple-A batteries. With batch transcription and environmental noise compensation, the package is a compelling way to take your dictation on the road.

The 2-ounce DS-150 is half the thickness of the Dragon NaturallyMobile recorder and, with 8MB of flash memory, holds up to 75 minutes of speech—35 minutes more than Dragon's offering. Like the NaturallyMobile recorder, the DS-150 lets you dictate using an attached microphone or directly into the built-in mic.

A menu button lets you easily navigate among and edit recordings or change settings, such as the date and time or microphone sensitivity. An LCD shows the dictation mode, length of the current recording, time remaining in memory, current folder, and battery status.

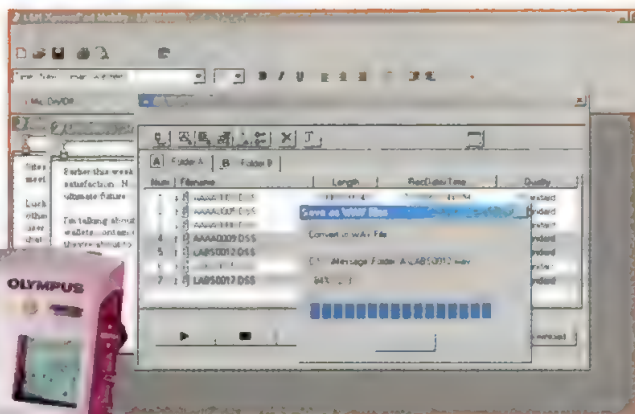
We found the DS-150 easy to use and convenient for quick notes. For accuracy in longer dictations, you'll want to use the included headset microphone. A handy voice-activated recording feature pauses after 2 seconds of silence and resumes recording when you start speaking.

Before you transcribe your recordings, you must enroll the DS-150 into Voice Xpress as an input device. This requires reading a choice of training text and takes about 10 minutes.

To transcribe recordings, you connect the DS-150 to the in-

cluded serial cable and attach the cable to your PC's serial port. The Olympus DSS Player software lets you download recordings one at a time or in batches. Once recordings are downloaded to your PC, you use L&H XpressPad Mobile to listen to the WAV files or transcribe them into text.

During transcription, XpressPad recognizes such commands as "comma," "period," and "new paragraph," so you can include basic formatting in your dictations. We had satisfactory results dictating into the built-in microphone, and the environmental noise com-



▲ **ALL TOGETHER NOW:** Voice Xpress lets you download and transcribe recorded WAV files from the DS-150.

pensation feature did a good job of canceling out background noise.

The L&H Voice Xpress Mobile Professional package will appeal to those who are comfort-

able taking quick notes by voice (doctors, for example) and to those who do a lot of dictating. **L&H Voice Xpress Mobile Professional.** List price: \$229.99. Lernout & Hauspie Speech Products, Burlington, MA; 781-203-5000; www.lhsl.com.

Documents into Web Pages

HTML Transit 4.0 isn't cheap, but its time-saving features will pay for themselves.

By Edward Mendelson

Most of your important documents may be destined to appear on the Internet or an intranet, but you probably still create them in a word processor or spreadsheet program. HTML Transit 4.0 (\$495 list; upgrade, \$99), from InfoAccess, does a better job of converting documents into Web pages than any of its rivals.

The program lets even novice users create a fully linked Web site, complete with contents and index frames, using a consistent graphic style based on one of

the program's templates. Expert Webmasters can customize and fine-tune every detail of the program's output.

Transit's optional wizard interface helps you start building a Web site by letting you choose a document to convert into a Web page and then select a graphic style for automatically created navigation bars. After a few seconds, Transit outputs a "publication" that consists of the converted file, a contents page, and a file in which Transit stores your formatting options and the list

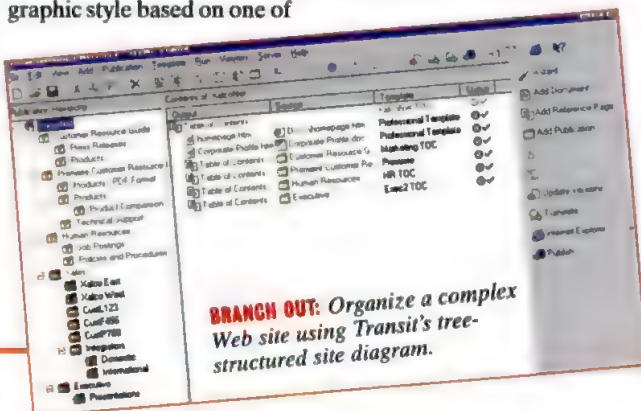
of files to include in the publication.

Publications are edited in an Explorer-style main interface. As documents are added to a publication, the program updates the contents page and can add an index or a list of illustrations.

Customization options let you match styles and formats in legacy documents to precisely controlled HTML code and insert custom-built HTML anywhere on a page. An experienced Webmaster can easily create conversion templates that will make Transit convert legacy documents into pages that match the existing style of a corporate Web site.

The program isn't cheap, but its main rivals—Lotus's barebones FastSite and Corel's advanced server-based NetPerfect—do not approach HTML Transit 4.0's graphic flair and customization options.

HTML Transit 4.0. List price: \$499; upgrade \$99. Requires: 16MB RAM, 25MB hard disk space, Windows 95 or later. InfoAccess Inc., Bellevue, WA; 800-344-9737; www.infoaccess.com.



BRANCH OUT: Organize a complex Web site using Transit's tree-structured site diagram.

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Statistics by the Scripts

With S-Plus 2000, MathSoft has upgraded all aspects of this leading statistical program.

By Barry Simon

Whether you are involved with statistical analysis in the financial, pharmaceutical, manufacturing, or academic fields, you are most likely familiar with MathSoft's statistical toolbox, S-Plus. The new S-Plus 2000 program comes in two versions—the Standard (\$780 list) edition and the Professional edition (\$2,195 list). The Standard edition is used for interactive GUI-based statistical analysis and plotting; the Professional edition adds a command line interface and tools to develop procedures in the program's proprietary S programming language.

New to S-Plus 2000 are correlated error regressions, additional chart types, improved OLE automation, an interface made to resemble Office 97, and the ability to save entire workspaces. Also, on any plot, you can now hover over a point and get the point data displayed as a tool tip.

One new feature of special interest to financial users is that S-Plus 2000 now provides links to online financial data. The software uses Internet technology seamlessly in its ability to import data from the Bloomberg, FAME, or LIM databases. Of course, you need a subscription to these databases to get the data, but the process is then easy.

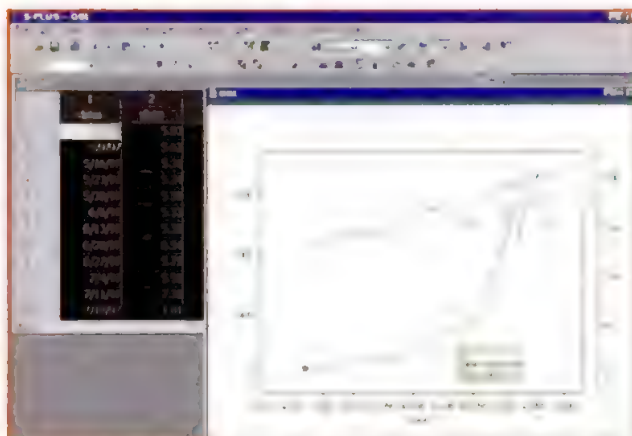
For example, you can use a simple Import Data dialog in S-Plus to capture data from the Bloomberg site. You can then use all of S-Plus's formidable data analysis and manipulation tools to go beyond what you get with Bloomberg.

We were disappointed that, with the S language making this program the most customizable of statistics packages, the user interface for programming is as dated as it is. No dialog editor is provided, and you cannot color-

code keywords in the program editor. Although you can place the equivalent of breakpoints in the code and then ask for the values of variables in a command mode, the program does not offer formal watch lists.

On the positive side for potential programmers, S-Plus keeps a history list of all actions you make in the program as S commands—almost as if you have macro recording on at all times. And if you copy a plot into a script window, the program inserts the S code to produce that plot into the script.

The programming environment has room for improvement, but S-Plus 2000 Profes-



▲ **GET TO THE POINT:** S-Plus 2000 links to financial databases (here Yahoo! is plotted against S&P) and provides point data in tool tips.

sional, because of its strong proprietary language, is the tool of choice for those who develop their own statistical procedures. S-Plus 2000 Standard is a serious choice for users looking for an interactive statistical environment.

S-Plus 2000. List price: Standard, \$780; Professional, \$2,195. Requires: 32MB RAM; 115MB hard disk space; Windows 95, 98, NT 4.0, or higher. MathSoft Inc., Seattle; 800-569-0123; www.mathsoft.com/splus.

Spread the Word

MessageBlaster.com is a Web service that acts as your personal emergency broadcast system.

By Don Willmott

Here's the scenario: Everyone from the office has scattered for the weekend, but you've just received an important piece of news that they all need to hear right away. How will you contact them? Some people may be on e-mail. Some may not. Some may have cell phones. And again, some may not.

MessageBlaster.com will take your short text message and

broadcast it to a list of people you specify. The service can send the message to e-mail addresses and to fax machines; it can convert the message into speech for transmission via telephone; it can even print the message onto a postcard for traditional mail delivery.

Prices are inexpensive—15 cents per minute for phone calls and 10 cents per fax page, and e-mail delivery is always free. During MessageBlaster.com's launch phase, the end of which hasn't been determined, all of its services are free.

If you ask recipients a yes/no question, MessageBlaster.com will keep track of the responses as they filter back in (via e-mail or telephone keypad). If you'd rather not have a robotic voice read your message over

the phone, you can dial in to a toll-free number to record the message in your own voice.

In testing, MessageBlaster.com worked just as advertised, and the service was blazingly fast. We broadcasted a message to several office extensions, home phones, e-mail accounts, fax machines, and cell phones, and they all rang or buzzed within seconds. We did find the robotic voice slightly hard to understand, and on some of the telephones where we retrieved messages, we were unable to respond to the yes/no question with our keypad, because our voice mail system overrode the MessageBlaster.com system.

Don't confuse MessageBlaster.com with any of the many other Web-based, all-in-one communications solutions. Its only purpose is to help you contact many people by many different means and to do that job quickly. The good news is that the service succeeds.

MessageBlaster.com. Price: 15 cents per minute for phone calls; 10 cents per page for fax; free for e-mail. Prizma Inc., Billerica, MA; www.messageblaster.com.



▲ **REPORT BACK:** MessageBlaster.com compiles a detailed report about message success that is updated as people respond.

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Network Macs and PCs

The HomeLine Starter Kit lets you network Macs and PCs—and share Internet access.

By Bruce and Marge Brown

Looking for a simple solution for networking PCs and Power Macs and sharing Internet access? The Farallon HomeLine Starter Kit (\$140 street) is a great solution, offering easy setup, low cost per computer, and decent performance for SOHO applications.

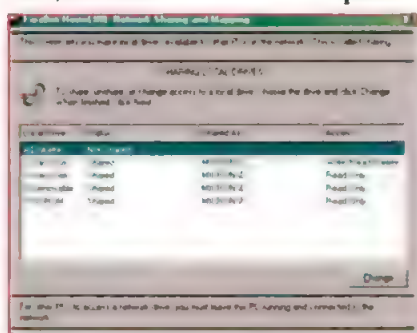
With this 1-Mbps first-generation Home Phoneline Networking Alliance (HPNA) product, a single telephone line is all you need to connect computers and access the Internet. The only downside of the product—the requirement that a Mac act as the Internet gateway with a mixed network—has been resolved with Microsoft Windows 98 Second Edition's Internet Connection Sharing feature. (Note that if PCs on your mixed network run Windows 95, you'll have to use the Mac as the Internet gateway.)

The HomeLine uses Intel's AnyPoint HPNA chip set and software, but it's the only product on the market that supports both Macs and PCs on a phone-line network. The Starter Kit includes 2 PCI cards; for an additional \$80, you can get a single pack to add another computer to the network.

To test the HomeLine, we went right to the most challenging configuration: hooking up a PC and a Power Mac G3 with one phone line that would be used for both the network connection and Internet access. First, we configured the PC to access the Internet via Earthlink, and we upgraded the computer to Windows 98 Second Edition (minus the Internet Connection Sharing feature). Then we installed the HomeLine PCI cards and drivers in both computers.

We used one phone jack with a line splitter for the network;

we then plugged the included RJ-11 cables into the HomeLine card in each computer. On the PC side, we connected an external 56K modem to the HomeLine card. You can use virtually any type of modem, however, including cable, and DSL, and ISDN.



Next, we added Windows 98 Second Edition's Internet Connection Sharing component (which won't install without a network card present). Then we configured the HomeLine software on the PC so that the PC would be the server for Internet-access sharing. After installing software on the Mac (specifying that the Mac would share Internet access as a client), the only other step required was to configure the

Mac to use DHCP.

To go online, we clicked "Browse the Internet" on the Mac. An Internet Explorer screen opened, and almost immediately

◀ **A FAIR SHARE:** The HomeLine software makes it easy to configure drives for sharing the network.

the modem attached to the PC started dialing. In less than a minute, we were browsing the Web. We then launched IE on the PC and started browsing on that system simultaneously.

Sharing a 56K modem connection isn't the fastest way to access the Internet, but the system worked easily and well. Even if you connect via a cable or DSL modem, you'll be constrained by the HPNA's 1-Mbps maximum data rate. For moderate duty, however, particularly in mixed PC and Mac environments, the Farallon HomeLine Starter Kit is a terrific solution.

Farallon HomeLine Starter Kit. Street price: \$140. Requires: Windows 95 or 98 for the PC; System 7.5.5 or higher for the Power Mac. Farallon Communications Inc., San Leandro, CA; 510-346-8000; www.farallon.com.

Build a Document Center

The Lexmark OptraImage provides an all-in-one solution for networked small businesses.

By Steve Rigney

How can small to midsize businesses print, copy, scan, and fax large quantities of documents without spending a fortune? Lexmark offers a solution with its new Lexmark OptraImage (\$6,444 list, as tested).

The OptraImage is available either as a complete kit (including scanner, printer, and control panel box) or as an add-on option for existing Lexmark printer customers; prices range from \$1,700 to \$9,700, depending on configuration. The setup we tested included an Optra S1855 printer, a Ricoh IS01 scanner, a MarkNet print server, and an external control panel.

The OptraImage lets you attach a scanner to a laser printer to scan and make copies at up to 24 pages per minute. The system also offers network print and fax, as well as client software for faxing directly from the desktop.

The power behind this solution is in the MarkNet print server card, which fits into several Lexmark printers. The card has a Fast Ethernet adapter, a 14.4-Kbps fax modem,



▲ **ALL YOU NEED:** The OptraImage is a multifunction solution for small to midsize businesses.

and a SCSI connector. The SCSI adapter connects to the external control panel, which has its own SCSI connection for the scanner. Because the scanner has two SCSI connectors, you

can also attach a PC to the unit.

Scanning and copying functions are performed using the external control panel. This device has the same function keys you'd find on a copy machine, including print enlargement, resolution, number and size of copies. The unit also has an easy-to-read LCD.

The OptraImage offers several ways to deal with faxes. You can scan pages in, key in the fax number, and hit the send button on the control panel. You can also send a fax via the Lexmark printer driver (which can detect the presence of the MarkNet adapter) from a Windows-based PC on the network; the fax option simply appears as an output device.

For businesses that are too big for personal multifunction devices or too small for professional document solutions, the Lexmark OptraImage system may be just right.

Lexmark OptraImage. List price as tested: \$6,444. Lexmark International Inc., Lexington, KY; 800-539-6275; www.lexmark.com.

Securing Your Network

L-3 Network Security's Retriever 1.0 helps you identify possible security holes in your network.

By Steve Rigney

Some network administrators wouldn't even know that their network had been compromised until they saw that someone had drawn a fake mustache on the CEO's picture on the company's Web site. Other administrators are more vigilant, but they don't have the time to search the Web for new vulnerabilities for all of their e-mail, Web, FTP, and file server products connected to the Internet.

Likewise, controlling users and preventing them from connecting modems and setting up ad hoc remote-access servers can be a full-time job. The only solution is a security scanning application that can monitor the network for you. Unfortunately, these products can cost thousands of dollars and require extensive knowledge of TCP/IP services and protocols.

L-3 Network Security has introduced a package called Retriever 1.0 that's not only easy to use, but at \$500 for up to 255 IP addresses, it is also one of the most inexpensive scanning programs on the market. Retriever can scan for security holes, diagram your network, predict possible vulnerabilities, and discover modems and other access devices the administrator doesn't know about or approve.

Getting Set Up

Retriever is sold based on the number of IP addresses you want to scan. For example, for a single Class C network (up to 255 addresses), pricing starts at \$500 a year, which is an annual subscription that includes updates to the vulnerability database, free Web-based technical support, and free upgrades to

the software. The cost per address drops down for larger installations. You can download a demo and a seven-day evaluation copy from L-3's Web site (www.L-3security.com).

We found this product easy to install, but unfortunately we were unable to define where to copy the files. This is only a problem if you don't want to install the product to the default location on your C drive because of security or space requirements. The software runs on any Microsoft

protocols to discover all of your intranet devices, including versions of software.

By comparing these devices and version information with Retriever's database, the software can alert you to known vulnerabilities without actually trying to hack into each device. The administrator then must decide which vulnerabilities need to be addressed and what devices are not important.

For example, on our tests, Re-

Security Alerts

triever doesn't leave everything up to the administrator to decide; the product includes a rating system that identifies the most serious vulnerabilities. This system works by alerting administrators to the components that have the largest holes and helping them to decide which problems to fix first.

But unlike products such as BindView NOSAdmin for NT, Retriever can't fix the problems

for you. For example, if NOSAdmin finds an Windows NT server with a password that's easy to guess, you are forced to make a password change. Retriever doesn't go that deep—it only informs you about the version of Windows NT and the services running on that server.

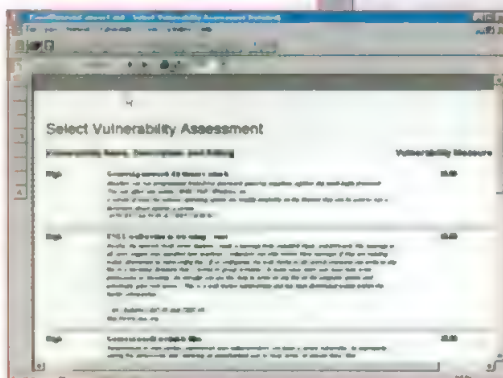
The predictive modeling feature is a great way for administrators to check for security holes before they happen. You can use Retriever to de-

▲ SILENT TYPE: Retriever uses a nonobtrusive ping to discover all of the devices on your network.

trieve alerted us that we were running an older version of IIS with several possible security holes. The utility left it up to us to decide whether to download a new version of the offending

software. If no upgrade is available, Retriever can recommend changes that will resolve the problem. The Retriever database currently contains information on 2,000 network components and 750 vulnerabilities associated with those components.

The network mapping tool can also discover modems on the network. This prevents users from installing Symantec pcAnywhere, Windows NT RAS, or other products that let them dial in from home—and unknowingly leave a hole for potential intruders. Unprotected dial-in modems are one of the biggest access points for network intruders.



▲ SURVEY SAYS: The Vulnerability report shows the problems Retriever found and how important they are to security.

Windows 9x or NT-based client PC. Access to the vulnerability scan is also based on password security to prevent unauthorized users from finding possible holes in your network.

Mapping Your Network

One of the best features of Retriever is its ability to map your network and possible security vulnerabilities without being obtrusive. Most security scanning programs (such as Internet Security Systems' \$2,795 Internet Scanner) run active probes on your network that can substantially increase network traffic. The Retriever network mapping tool uses standard TCP/IP

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Affordable Networking

Share your cable or DSL modem across your small network with the BeadleNet SOHO 2000.

By Bill Machrone

Cable modems and DSL lines are proliferating faster than anyone predicted—and so are home and SOHO networks. Sharing that bandwidth among your machines is the logical, inviting thing to do. If only it were easy. Software solutions such as CommSocks, ShareTheNet, WinGate, WinProxy, and others abound, but they require configuring a machine with two network cards. Routers do the job in hardware, but they have been too expensive and too complex for small peer networks.

The BeadleNet SOHO 2000 joins a new generation of router/firewall/access-sharing devices tailored to small networks. These devices are less expensive, small and unobtrusive, and

most important, they're easy to install and maintain. Unlike some competitors, the SOHO 2000 (\$399 direct for four users) also includes a four-port hub.

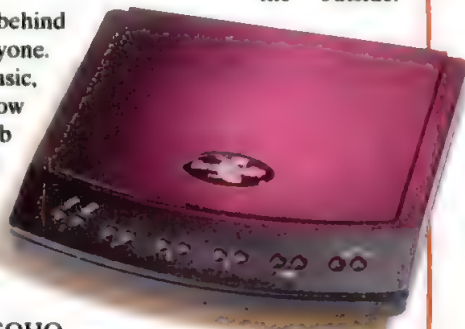
When you plug the SOHO 2000 into your DSL or cable modem, it acquires your IP address from your ISP. Some modems may have to be reset for this to occur, but our Motorola CyberSurfr just dished up the address without a fuss. When you plug your PCs into the SOHO 2000's Ethernet ports, they're assigned nonroutable IP addresses in the 192.168.111.x space. You have to set the TCP/IP properties of your PCs to obtain an IP address automatically and to use DHCP for WINS resolution. If you've installed the Client for Microsoft Networks and turned on file and print

sharing, your machines network seamlessly behind the firewall while sharing the high-speed connection via Network Address Translation.

You can stack hubs behind the unit to connect everyone. Some versions have a basic, robust firewall; others allow configuration and Web hosting. The firewall is currently too tight to allow tunneling protocols for virtual private networks, but a fix is in the works.

You control the SOHO 2000's settings through a password-protected internal Web page, visible only to the administrator machine on your network. You can manually enter IP addresses and control the firewall settings. The firewall, which uses Stateful Packet Inspection, denies all open requests from the outside, with specific exceptions for services such as FTP or ICQ. You can

open holes for hosting, pass port requests to a specific machine, or enable IP DMZ passthrough for fully exposing a server to the outside.



▲ VERSATILE: You can buy the SOHO 2000 with support for 4, 10, 25, or 175 users.

In several weeks of service, the BeadleNet SOHO 2000 has been fast and flawless.

BeadleNet SOHO 2000. Direct price: 4 users, \$399; 10 users, \$655; 25 users, \$850. BeadleNet LLC, Laguna Hills, CA; 949-348-4240; www.beadlenet.com.

Catch the Wireless Wave

The NDC InstantWave products hook to your wired network to provide wireless connectivity.

By Les Freed

After several years of false starts, we're finally starting to see new wireless networking products that are IEEE 802.11-compliant. The latest is the NDC InstantWave package, an attractively priced system designed for office PCs.

The InstantWave line consists of three products. The NDC InstantWave Access Point (\$1,195 list) hooks up to your existing LAN and provides connectivity between the wired and wireless worlds. Each PC will need an InstantWave wireless LAN card (\$429 list), available in both ISA and PC Card formats. The NDC Access Point (AP) and ISA cards come with an external antenna and 4-foot cable; the PC Card has a built-in antenna.

The Access Point is a nondescript gray box with eight

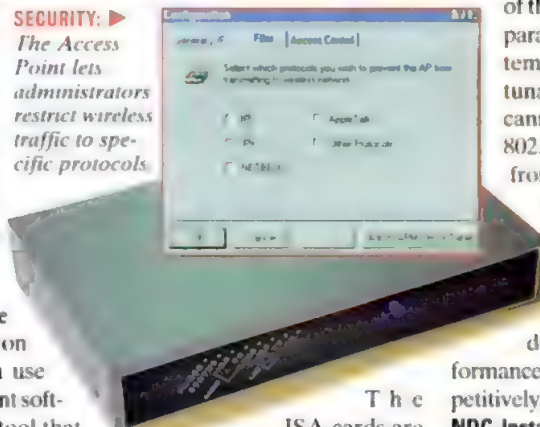
LEDs and an antenna connector on the front. The rear panel provides Ethernet, serial, and power connectors. The Access Point has two levels of management: With one AP on the network, you can use the APComFig tool, a simple management tool that lets you set up and monitor AP operations from a PC connected to the AP via a serial cable.

If you have more than one Access Point on the network, you can use NDC's AP Management software, a SNMP-based tool that operates over TCP/IP and lets you set and change security and protocol settings. A separate Trap Server lets you configure the AP to send SNMP trap mes-

sages to an SNMP console on predetermined error or traffic-load conditions.

The InstantWave client cards are easy to install, and they include drivers for Windows 3.1, 95, 98, and NT 4.0, as well as ODI-layer drivers for use with older NetWare systems.

SECURITY: The Access Point lets administrators restrict wireless traffic to specific protocols.



The ISA cards are Plug-and-Play capable, and we had no problems installing them in several client PCs. Like most ISA network cards, the InstantWave ISA

cards require a free IRQ.

The client software package includes troubleshooting, signal strength and site-survey tools. These tools let you check wireless signal and traffic levels from each client.

Our test LAN performed well, delivering about 1.6 Mbps of throughput. This is comparable to other 802.11 systems we've tested. Unfortunately, the Access Point cannot interoperate with 802.11 wireless systems from other vendors. NDC hopes to remedy this with a firmware update in the near future. In the meantime, this product offers excellent performance and usability in a competitively priced package.

NDC InstantWave Access Point. List price: \$1,195. **NDC InstantWave ISA and PC Cards.** List price: \$429 each. NDC Communications Inc., Sunnyvale, CA; 800-632-1118; www.ndclan.com.

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Revisiting Streets & Trips

By Marge and Bruce Brown

Reader reaction to Microsoft Expedia Streets & Trips 2000 spotlighted the strong points and the drawbacks of the program and of consumer mapping software in general. Among the admired traits are an elegant, uncluttered interface and improved location-seeking and route calculation, as well as the convenience of a single product with both street-level addresses and trip planning.

But no product is perfect. Among the lamented missing

features are GPS support and the ability to load part of or the entire program to a hard disk. Microsoft purposely left GPS support out of Streets & Trips 2000 because the company claims that few general consumers use GPS devices.

Respondents also complained about having to assign pushpins manually. And within the construction update feature, a year/date-reporting anomaly mentioned by two readers reported the years 3897 and 3899 instead of 1997 and 1999. (We could not replicate the error.)

But the harshest opinions had to do with routing errors and missing or incorrect addresses or place data. Some writers mentioned specific addresses that were misplaced or absent, or that had unusual place names that weren't familiar to locals.

The reality is that no consumer mapping software is perfect, even when you don't count traffic conditions and construction. On a recent trip, we found that Streets & Trips 2000 couldn't find a street address that DeLorme's Street Atlas USA 6.0 found handily. But products from all four of the major consumer mapping software com-

panies (adding Rand McNally and TravRoute to the group) contain errors and will likely make some routing errors.

So far, mapping and routing is an imperfect exercise that only becomes a dire problem if you rely on that information solely, without backing it up with paper maps and without a willingness to stop and ask for directions. And most of the address and routing data in all of the consumer mapping products is right on the mark. Features and interfaces differentiate the products more than accuracy levels do, despite software publisher claims to the contrary.

PDA Versus PDA

By Bruce Brown

We struck a major chord with this topic, and readers responded with strong opinions about the relative value and usefulness of Windows CE and 3Com Palm PDA devices. Although color-display palm-size Windows CE machines are just beginning to be available, several of our respondents have used the newest devices and in some cases are reverting to their Palm PDAs. Color screens are great, many say, but not at the expense

of battery life or system performance.

Other users are excited, as we are, by the display and audio capabilities of Windows CE PDAs.

The votes are not all in, of course, and as palm-size Windows CE units become more widely available, we'll watch this field closely. At this point, two nuggets of con-

ventional wisdom regarding this nascent category remain true. First, the "personal" in PDA remains foremost; users are likely to have strong

afforded by the Type II CompactFlash slot on all current models is another major difference between them and the Palm models. Several manufacturers now sell CF modems

with drivers for Windows CE and at least two—Socket and Xircom—sell CF LAN adapters. Several manufacturers sell CF memory cards, which enable both hand-held and palm-size Windows CE devices to serve as digital image storage, management, editing, and even presentation devices.

The long-awaited IBM MicroDrive

340MB CompactFlash hard disk has been announced as shipping and is purportedly for sale (\$500 street), although as this was written, no resellers list the drive as available. Long-awaited CF pager cards are still vapor, reportedly due to RF interference problems, but Socket has announced its Digital Phone Card, expected to ship in September 1999 along with Microsoft's Wireless Communications Kit for Windows CE, with cable connection options for wireless access using CDMA and GSM digital phones.



ONE OR ANOTHER: Palm (left) and Windows CE devices each appeal to different users.

preferences and opinions, and they can add software and (to varying extents) hardware to personalize their PDAs even more. Second, Palm devices are faster, smaller, and easier to use, and they have longer battery life than Windows CE devices, but the Windows CE devices have greater capabilities and features.

In addition to the color displays and audio playback of Windows CE devices, the expansion and connectivity edge

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Tell us what you think...How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below are just a few of the comments from our discussion of Microsoft Expedia Streets & Trips.

After using another (older) product, I think *Expedia Streets & Trips 2000 is fantastic. Perfect? No, not by a long shot. Pushpins are clumsy and very difficult to place exactly. Some areas in the database are covered beautifully; others don't even exist. I was fascinated by the ability to pull in aerial photos of selected geographic areas—a capability that came as a surprise.*

—D. Purdy

I've plotted a couple of routes *since I got Expedia Streets & Trips. One was flawless from start to end. A second route to a wedding at Old World Wisconsin (which is a listed attraction) was less successful. The trip from home to a town near Old World Wisconsin was fine, but the directions from there to the final destination were hopelessly muddled.*

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The glory days of hand-coded Web sites are over. Generators can finally do more and do it better. Yes, there will always be reasons to tinker with the code, just as you override your word processor's stylesheets when appropriate. And yes, this pronouncement will produce a passel of URLs of complex sites that

are coded entirely by hand with Notepad.

The existence of these lovingly hand-coded sites doesn't change the fact that more and more people have to publish Web sites, and they couldn't care less whether the underlying language was HTML or pig Latin. At the same time, Web generation tools have gotten vastly better, and they serve many levels of expertise, from basic pages to multitiered sites.

Whether you choose Microsoft FrontPage 2000, HoTMetal PRO, NetObjects Fusion, or any of half a dozen others, you'll find yourself generating sites with sophisticated navigation features that are difficult to update by hand. Inserting pages in a forward-back chain is an everyday annoyance, and moving pages around in a hierarchical structure is a major pain, but most of these packages handle both without breaking a sweat.

You may also want to have modern features such as buttons that change color on mouse-overs, animations following clicks, or other behaviors. That's a lot of tedious JavaScript coding. And when you're all done, there's the strong likelihood that your boss won't like the color scheme. If you've hand-coded, you're looking at the mother of all find-and-replace macros to change all the buttons, but with a site generator, you just click an option and it's all done.

Fast turnaround has become the name of the game in a lot of corporate Web publishing. Hand coding just takes too long to remain a competitive option. But beware: Some code generation tools are a triumph of style over substance. For instance, Office 2000 now supports HTML as a native file format and lets you do wondrous things, such as embedding fully operational Excel pivot tables in Web pages. But look carefully at the amount of code generated, the maintainability, and the download times. Some of those controls are big, and you have to weigh user convenience against bells and whistles.

Then there are DHTML and XML. Sure, you can hand-code DHTML. It's actually fairly straightforward. But it's also tedious. If I need to do an animated site, I probably want to use Dreamweaver. When

I want to do animations within a window or fancy dissolves and moving objects, Macromedia Flash is my tool of choice. XML basically means making up your own HTML and complying with your own rules. Some of the new XML tool sets make it a whole lot easier than keeping all that in your head.

Look at the continually growing specter of e-commerce, with heavy back-end interfaces to databases, credit card-approval systems, and scripts that do suggestion selling, tie-ins, discounts, and who knows what else. I'd love to ensure the uniqueness of my site by hand-coding it, but time-to-market is everything. Getting there first has incalculable value.

Even hand coding is getting an assist. HomeSite is still generally considered the best HTML editor, yet it has many powerful assists built in, from code completion to syntax checking, from table wizards to a host of other features that reduce repetitive tasks to a click. HomeSite's extended find-and-replace feature is reason enough all by itself for sophisticated Web developers to own the package.

Virtually every site development tool lets you flip back and forth between code views and page views or between page-building views and page-preview views. But only one (that I know of) gives you both at the same time. xSite, a free program available from ZDNet's Software Library (<http://hotfiles.zdnet.com/cgi-bin/textis/swlib/hotfiles/info.html?fcode=000ZSD>), gives you side-by-side windows. You type HTML in one and watch your page take shape in the other. Though xSite would appear to be the ultimate hand-coding tool, it too has powerful assists built in to simplify complex tasks. Chief among them are a pair of JavaScript palettes that make script development and editing vastly easier, by keeping all the syntax you need right there in front of you. Another cute xSite feature is the Body Snatcher, which follows the Web pattern of borrowing or stealing any code that you find appealing. One click and the program lifts the entire body of a target Web page and drops it into your editing window, so you can modify it to your tastes. 



Fast turnaround has become the name of the game in corporate Web publishing.

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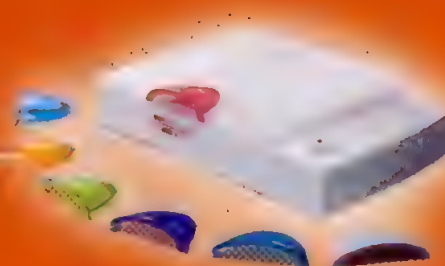
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The Internet Bubble

It's fun to watch the stock market set new records and see companies with no track records and little to offer skyrocket to fame while their owners get rich overnight. Half of the observers talk about a bubble about to burst, while the other half says it's only the beginning. Who's right?

Nobody has a clue about any of this. All the Internet and technology stocks could go down the toilet tomorrow, and there'd be rationalizations like "These stocks were overvalued, and the hope for them was unrealistic." Or these same stocks could double again, and the same folks would say, "In fact, these stocks were undervalued all along, but the true conservative nature of the investment community kept their prices low until reality set in." It's hard to predict what's going to happen, so we have to look carefully at numerous false assumptions underlying the Internet stock phenomenon.

There's a zero-sum game at work. I've heard people talk about the entire economy increasing by a factor of 10. All this is because the Internet "opens the economy up." Opens it up to what? Even the government is jazzed. FCC chairman William Kennard mentioned how Africa could become a connected continent, citing how once it increases its telecommunications adoption rate, it will add millions of people to the usage pot. There's some odd belief that if you get people connections—assuming they can even afford those connections—they're going to buy something.

It's further assumed that whatever they buy online won't impact the non-Net seller. If I buy a Lexus on the Net, the local dealer has to be affected. I'm going to buy only one Lexus; the Net doesn't make me want to buy more. Phenomena such as eBay make it look like people are buying more, but eBay affects swap meets and garage sales. The economy shifts, but that's all.

It's the information, stupid. I'll argue this until I'm blue in the face: The Net is best for information gathering and dissemination, not e-commerce. Content, in fact, is king. Cynics will point out that as a content creator (look Ma, no typewriter) I'm seeing the Net like one of the blind men describing an elephant.

I understand that the Net, like an elephant, has more than one or two features. But there are aspects that are overriding. Let's compare it to TV, another

content medium. Nobody would argue that TV's primary mechanism is anything other than content delivery. It has advertising, but only to support the content. People watch TV for content and hate ads. Is there a T-commerce element? Yes, it's called infomercials. But does anyone think that TV would survive if this were all that was on? Does anyone watch TV just to buy stuff? How is the Net different?

People keep forgetting that the Web is a form of publishing that anyone can do. I'm not just talking about vanity Web pages. You can buy entire auction software systems and put up your own eBay. More important, the big so-called mortar-and-brick companies that are about to be displaced by the smaller Internet hotshots can also get on the Net.

Many of these big companies seem slow on the draw, but they have the kind of money to make up ground fast. Barnes and Noble, for example, should eventually be able to figure out how to do the Net right. Borders and Crown are sure to follow. I see no reason why small antiquarian booksellers, as well as all the used-book palaces, can't be online, too. This is true for all business. Who wins with this scenario? The companies that make plumbing for the Net, not e-commerce companies. And what happens when all the plumbing is in? You tell me. I expect to hear a loud crashing sound.

Observable growth is what has kept the Internet stocks pumped. The high-profile sites have done an excellent job of staying on the growth curve, and the few companies that actually make money haven't suddenly turned into money losers. This, of course, will stop at some point (not before this column goes into print, I hope).

When reality comes back onto the scene, we'll hear a lot of hindsight analysis, and we'll all be reading the words "unrealistic," "expecting too much," "still evolving," "shakeout," and all the rest of it. There will be endless discussion about how the real problem may have been immature management unable to react to rapidly changing conditions. Blah, blah, blah. I've heard it all before.



I've heard people talk about the economy increasing by a factor of 10. All this is because the Internet "opens the economy up." Opens it up to what?

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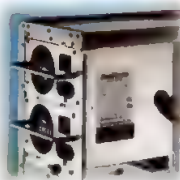
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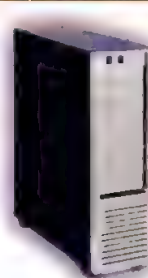
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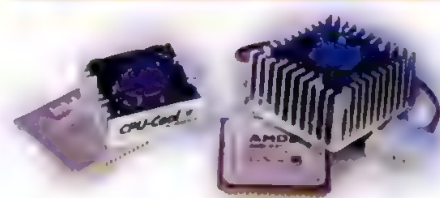
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John C. Dvorak's



INSIDE TRACK

Whether We Like It or Not Dept.: One of my fellow columnists was raving recently about how we're running out of IP addresses. He claimed the load on routers is so **horrible** that **we're all doomed** if we don't move quickly to IP, Version 6 (which gives us virtually infinite IP addresses).

The debate over our running out of IP addresses ended years ago, soon after the shortage emerged as an issue. The fix was made immediately: **variable IP addressing**. If you're just Web-surfing, there's no reason your machine should have a fixed and permanent IP address, because you're sharing from a pool. UUnet was the first ISP I saw using this technique, and now **almost everyone does it**.

The newer 24/7 connections, such as ADSL or cable modem lines, might require a fixed IP address. But even within an organization or household using such a connection, the IP can be shared with various IP spoofing tools. And software systems can handle the other machines on the network. As for routers, look into the ATM IP/label-switching routers to eliminate bottlenecks. The point is, there's no reason to panic. Exactly **what is the point** of bringing up this old debate when it's a dead issue?

I expect to see more such concerns for one reason: **the mistaken belief** that the public is going to demand Internet appliances. This is the motive here. Internet appliances will eventually all come with fixed IP addresses. I'm referring to those **washing machines with IP addresses**.

(One thing to note: The term *Internet appliance* seems to have taken on two meanings. One is a computer-like tool used to access the Internet. So simple and easy to use it can be called an "appliance." This definition harks back to when the Mac first came out, and an attempt was made to call it an "appliance computer." The other definition is the more ominous situation I described above—a traditional appliance that has been given Internet connectivity for whatever reason. I suspect the confusion will end with the invention of a newer term for one or both of these concepts. Until then, always ask for clarification when someone begins to talk about Internet appliances.)

I've discussed this before, but let me reiterate the **strategy and scheme** behind the traditional appliance type of Internet appliance. It's not so **your refrigerator can order your groceries**. Nobody has shown a successful business model to make that work. The Internet appliance does not exist to make coffee remotely or do the dishes or anything else. **It's for advertising**. Your refrigerator will have an LCD, and it will be flashing ads for everything from fast-food hamburgers to specials at the local grocery store.

Using a 1-megabit (or slower) network through the power lines (now you know why they've kept working on such a technology),

some central source will talk to the fixed-IP refrigerator **through the AC plug**, and there will be no way to stop it. The sick part about this whole scheme is that most people will **think it's neat** to have a little TV-like panel on the refrigerator telling them what's going on. I assume there will be **Dow Jones updates** and sports scores on the things, too. Why not?

The only example of something like this currently on the market is the cell phone systems on some planes. There's an LCD on the back of the phone, which faces the passenger, and it usually displays never-ending messages including a stock ticker and sports scores.

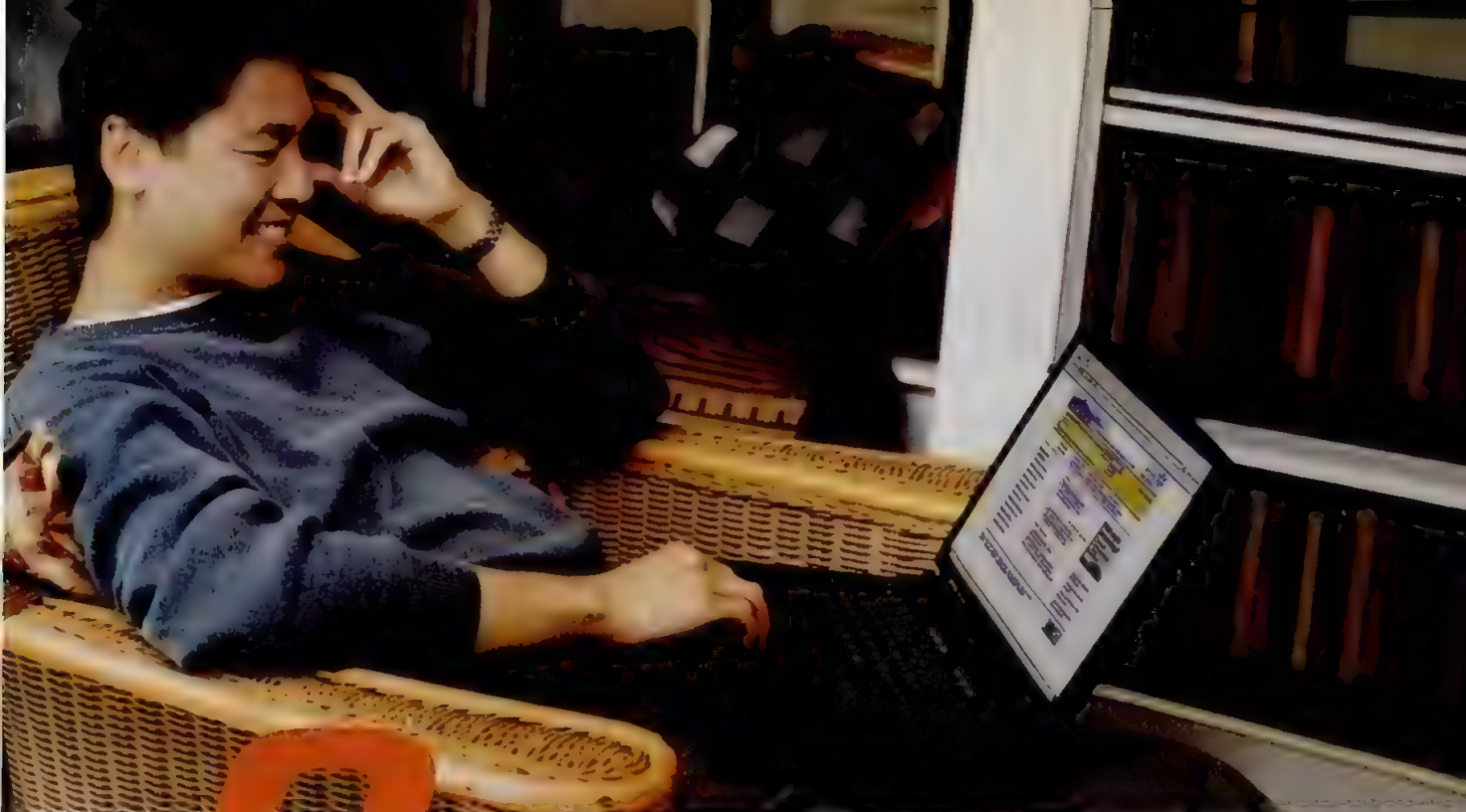
This mercantile/advertising thrust of the Internet appliance explains certain activity in the semiconductor arena. This is **the real reason** for the sudden interest in putting an entire computer on a chip. The argument against the computer-on-a-chip has always been that users want to change subsystems too often for this concept to be **practical**. Well, when we're dealing with an embedded computer in a refrigerator, this argument fails.

A few years ago all the news was about increasing speeds and capabilities of high-end microprocessors. Now everything is about these new compact chips. The most recent example is the new National Semiconductor "Geode" family of **Internet appliance chips**. The first chips in this series are for set-top boxes and things such as "Web pads." As prices go down, these processors, which are actually **repurposed Cyrix MediaGX chips**, will be added to the washing machine and refrigerator—and anything else that **plugs into the wall**—and to the ubiquitous power network/grid.

Meanwhile, the chip-manufacturing business has gotten so expensive and risky that it's trending toward the kind of cooperation and togetherness that comes close to **an OPEC-like situation** that could one day **threaten the world economy**. Nobody is noticing. The Sematech Web site (www.sematech.org) outlines some of the early meetings in Korea to develop a common industry road map so that all the suppliers and manufacturers can be on the same page. A careful reading of the press announcement regarding the summer meeting in Korea sounds a lot like a precursor to price fixing to me.

This sudden need to develop what's being called an **International Semiconductor Technology Roadmap** stemmed from the stumble the industry made to move to 300-mm wafers. All the suppliers of process equipment **got screwed** when the chip makers reneged on their promises. But this is the nature of competition and business. You say one thing, then don't do it. It's painful but healthy. Apparently the semiconductor industry would rather forgo the pain. Once the vendors start agreeing about their technology plans, can **agreeing about prices** be far behind? **PC**

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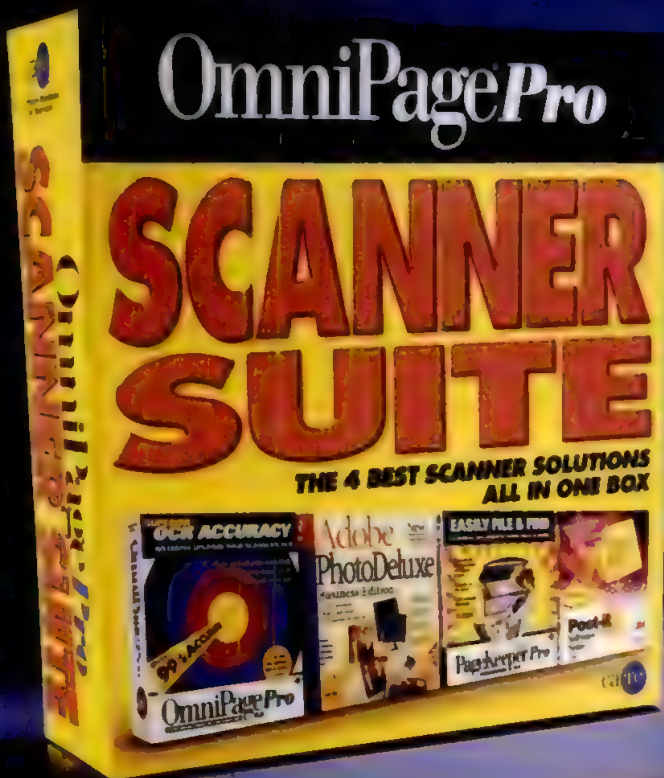
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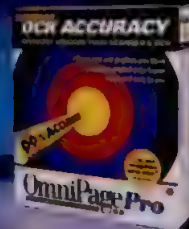
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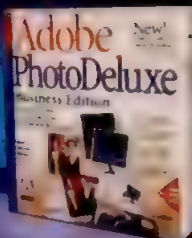


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The Value Proposition

Such a deal! We live in a society ever more engaged in the pursuit of great deals, and the PC business is hardly exempt. In a time of \$400 PCs, \$60 scanners, and \$70 color printers, prices for everything have fallen through the floor. Heck, at least half a dozen outfits will now “give” you a “free” PC, if you

agree to play the game their way or buy something such as monthly Internet dial-up service from them—or both.

Indeed, before long you'll see offers that purport to give you a free PC, give you free Net access, and *pay you cash* for every hour you're online. At least, that's the business premise of two computer-marketing/research outfits I've talked with in the past month.

All this “Let's Make a Deal” stuff has made it increasingly hard to decide how much to spend when we go to our favorite Web sites or stroll into Compu-Whatever. Often today, very good products are available for remarkably low prices. But in other categories, the plethora of cheap choices often turns out to be just that: products you really don't want, won't find satisfying to use, and are tempted by solely because of their low prices.

Sure, sometimes low-end/low-price products really are good deals and are worth buying. I've bought more than a few cheapo specials that wound up being given away—or thrown away. Sometimes you really don't want the lowest of the low but rather something a notch or two up from the very bottom.

Herewith two cases in point, of products that have passed through my office lately.

Dell has never been much of a player in the sub-\$1,000 PC market, let alone the sub-\$500 jungle. You'd been able to find a stripped-configuration Dimension or OptiPlex that squeaked in under \$1,000, but by the time you turned it into the machine you wanted, the price tag was a lot higher. That made sense for Dell, which has been resolutely focused on selling to businesses. But times and corporate strategies change. Now Dell's playing in that rough “subzero” league under \$1,000, and it has introduced a killer machine as its first entry.

The new Dell Dimension V (for *value*) series of desktops start under \$900 for pretty good configurations. I know: I've been using an \$879 Dell Dimension V400c for a couple of months, and it's a fine computer. At that price, you get a 400-MHz Celeron CPU, 32MB of RAM, a 4.3GB hard disk, a 40X

CD-ROM drive, an ATI 8MB video card, a V.90 56K modem, very decent small Harman Kardon speakers, and a good 15-inch monitor. I cheated and added another 32MB of memory for \$49 more. (I was tempted to cheat even more, by adding a 17-inch monitor, but that would have added another \$89, bumping the price of the system over a grand, which I wanted to avoid.)

What I got was a very nice system, in a superbly engineered microtower case (with, I should say, very few options for expansion). If there's a downside here, it's that the bundled software is Microsoft Works. Dell doesn't offer an upgrade to Office 2000 on its Web site, but if you call the 800 number, you'll find you can upgrade to Office 2000 Small Business Edition for \$89. Maybe less, if you negotiate a little.

I also got a one-year, next-business-day, desk-side-service policy and a three-year limited warranty. And I could have leased the system for \$34 a month on a 36-month lease. (I strongly discourage longer computer leases; the machine will be obsolete before the lease ends and you'll regret making the deal.)

So what makes this a smarter deal than a PC that costs \$399 to \$499, with \$150 to \$200 for a monitor, down at CompuPalace? First, when you add up the real cost, you'll find that you aren't paying too much more, yet you get a solidly designed PC from a brand-name maker, with good specs, a great keyboard, and industry-leading tech support and reliability. Yes, you could buy a bottom-shelf model from a discounter for maybe two-thirds of the \$928 Dell charged me for this machine (plus shipping)—but I'm convinced you'd be making a mistake.

Wonder why I didn't upgrade to a DVD-ROM drive, a larger hard disk, and so on? When you're in the market for a bare-bones machine, it's a mistake to gild the lily. The average buyer of a sub-\$1,000 PC isn't going to fill up the over-4GB hard disk in the V400c in the two years or so he'll have the PC. And I've yet to meet anyone who sits down at a PC to watch a movie on DVD. Spare the accessories: Concentrate on value.

Value has a lot of definitions and, without refer-



I like saving money as much as the next person, but sometimes buying up, not down, is the key to value.

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Jim Seymour

ence to your purpose, can be a pretty mushy concept. Item Two, the desktop scanner I've been using lately, brought that home.

We can get amazingly good scanners today for around \$100. If your scanning needs begin and end with color scans for posting on the Web, look no further than the excellent Visioneer PaperPort One-Touch models, which start at around \$90 (street). But just as buying a PC a few notches up from the bottom sometimes makes sense, buying an upmarket scanner can make sense, too. If a fair percentage of your scans are for print publication, you'll want something better.

I've been working with the stunning new Canon CanoScan FB 1200S. It's not a CIS scanner—as are most low-end units—but a CCD unit, using a cold-cathode fluorescent light source, which is the way to go for the highest-quality scans. The 1200S is not of the USB persuasion, unfortunately, but is a SCSI unit. Yet the scanner's results are well worth the modest hassle of installing a SCSI card.

At first I was horrified to see that the 1200S is a two-pass unit, an apparent step backward in an era of single-pass scans. But the two-pass scanning approach is part of what delivers the 1200S's amazing results: The second scan is refracted by half a pixel, and then the two passes are combined. The result is dazzling quality.

The 1200S is small: two-thirds the size of scanners with much lower quality levels. It has real optical resolution up to 1,200 by 1,200 dpi, 36-bit color, and a dynamic range of 3.3, and the unit has available both a sheet feeder and a large-format transparency adapter that does killer sheet-film scans.

The 1200S is the best flatbed scanner I've used. It costs about \$450, five times as much as the cheapest scanners but less than one-fifth the price of a scanner not its equal just two or three years ago. I think it's a bargain.

I like saving money as much as the next person. But sometimes buying up, not down, is the key to value—and the Dell Dimension V400c and Canon CanoScan FB 1200S are object lessons that spending *enough* can be as important as not spending too much. **PC**

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45	\$ 190	\$ 215	\$ 253	\$ 330	\$ 385
50	\$ 253	\$ 290	\$ 363	\$ 490	\$ 495
55	\$ 365	\$ 413	\$ 550	\$ 835	\$ 1,015
60	\$ 503	\$ 615	\$ 845	\$ 2,135	\$ 2,400
65	\$ 775	\$ 975	\$1,593	\$ 3,900	\$ 3,900
70	\$1,338	\$ 1,800	\$2,970	\$ 7,220	\$ 7,220
75	\$2,275	\$ 4,870	\$5,820	\$10,370	\$12,420

Male Premiums

Age	10 YEAR	15 YEAR	20 YEAR	25 YEAR	30 YEAR
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40	\$ 148	\$ 183	\$ 225	\$ 288	\$ 335
45	\$ 225	\$ 300	\$ 360	\$ 450	\$ 513
50	\$ 338	\$ 455	\$ 525	\$ 743	\$ 828
55	\$ 500	\$ 670	\$ 768	\$ 1,640	\$ 2,330
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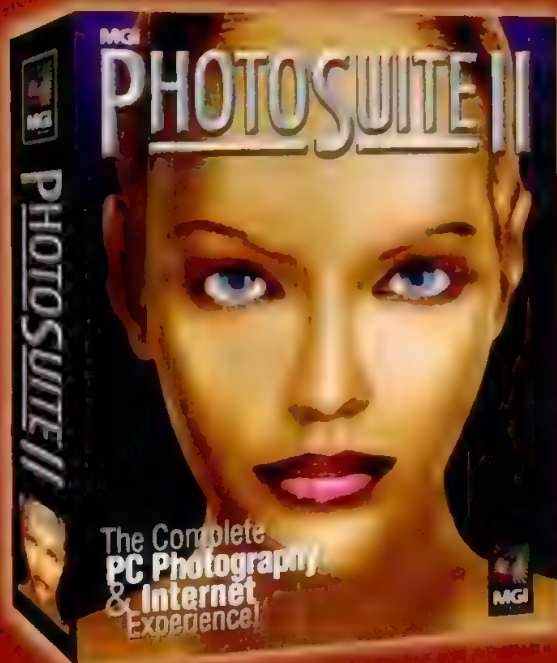
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Bill Howard

Five Tips for Productivity

Wherever you want to go today, you want to get there faster and with fewer hassles. As I think about what makes me more productive, I find it's less a matter of CPU horsepower, disk rotational speed, or the number of colors my monitor can display than it use to be. Here's a checklist to amplify your productivity.

1. Chuck the desktop PC. Get a notebook. Unless you live your life at your desk—and you have almost no meetings in conference rooms and don't travel—you should be carrying a notebook PC. Take electronic notes in meetings, not paper notes. If your company culture makes people uneasy about the clacking of keys in a meeting, the culture needs to change. You can meet 'em halfway: Learn to type softly. No, notebooks aren't as fast as desktop PCs, but they're fast enough and the screens are big enough that you won't be suffering a big trade-off.

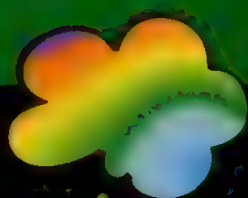
2a. In the office: Get a wireless LAN adapter. You've

2b. On the road (away from LANS or wired phones): Wait a while. You *can* use a cellular phone for wireless data transfers, but it's not very fast, and reliability is a mixed bag. The solution you want is one to two years away: Bluetooth, the 2.4-GHz short-range wireless RF communications standard-in-waiting. Your Bluetooth-equipped laptop will signal your Bluetooth-equipped cell phone, which will handle the wireless data transfer. Be patient.

3. At home: Switch to a cable modem or DSL. When you work from home, you won't suffer any noticeable speed bumps compared with being connected in the

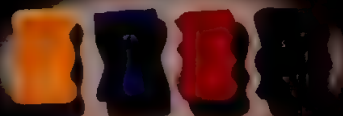


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MOBILE USER

Tasks: Internet browsing, word processing, e-mail, light gaming

Recommendations: AMD K6-2, Intel Celeron, Intel Pentium II



CORPORATE USER

Tasks: Internet browsing, word processing, spreadsheets, data access, presentations

Recommendations: Intel Celeron, Intel Pentium III



HOME USER

Tasks: Internet browsing (with some streaming and 3-D content), word processing, home finance, gaming, digital imaging, DVD

Recommendations: AMD K6-2, K6-III, Cyrix M II, Intel Celeron, Intel Pentium II
Gamers: AMD Athlon, Pentium III



PROCESSORS

the RIGHT

PC Magazine Labs tests today's major processors and finds that the new AMD Athlon steals the performance crown, and that the Pentium III's blue door isn't open just yet. By Michael Slater

The past 12 months have been tumultuous ones for PC processors. Intel revamped its entire product line yet again. AMD—despite financial troubles—has come on strong, first at the low end and now the high. Cyrix, after a good showing in the least expensive PCs during 1998, saw its market share collapse and found itself on the auction block.

All this activity means that you, as a PC buyer or integrator, are faced with increasingly complex decisions. Is it worth specifying an Intel Pentium III, or will a Celeron do the jobs you need done—for a lot less money? Or instead of a Celeron, is an AMD K6 or a Cyrix M II a better deal? And is Athlon the hot ticket AMD represents it to be? To answer these questions and, most important, to determine which chips are best suited to which types of users, PC Magazine

Labs performed a wide-ranging series of tests on all the major processor types and speeds available.

Our tests turned up two surprising findings. One, for the first time in Intel's history, a competitor—AMD with its new Athlon—is offering a faster x86 processor: On all benchmark tests, the

Athlon delivered the highest scores ever recorded by PC Magazine Labs. And two, the Pentium III chip did not noticeably speed up or visually enhance current Internet browsing when compared with a Pentium II chip of the same clock speed when accessing various 2-D, 3-D, and multimedia content elements included in numerous Web sites referenced by Intel's Pentium III WebOutfitter service (see the sidebar "The PIII and the Internet: What Is Behind the Blue Door?").

We also found that from a performance perspective, a top-of-the-line Athlon or Pen-

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SMALL OFFICE USER

Tasks: Accounting, desktop publishing, Web content creation

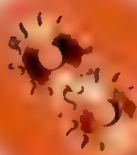
Recommendations: AMD K6-2, Cyrix M II, Intel Celeron



PROFESSIONAL USER

Tasks: Digital content creation (video, music, Web, desktop publishing), digital imaging, 3-D gaming

Recommendations: AMD Athlon, Intel Pentium III



WORKSTATION USER

Tasks: Software engineering, CAD/CAE, 3-D content creation, application server, Web hosting

Recommendations: AMD Athlon, Intel Pentium III, Intel Pentium III Xeon



SPEED for you

tium III processor is overkill for the majority of users. You may get more bang for your buck by trading up to a larger display, a graphics accelerator with a fast 2-D/3-D chip, more video RAM, a larger and faster hard disk, and a hardware DVD decoder. Here are our processor recommendations for certain types of tasks.

WORKSTATION/SERVER

Our testing reveals that, for now and the next six months, only the most demanding end-user applications, such as data-intensive office applications, Web content creation, and 3-D gaming, require a top-of-the-line (500- to 600-MHz) Athlon or Pentium III CPU. Workstation-class Windows NT machines for computer-aided design and engineering (CAD/CAE), software development, 3-D content creation, and professional video editing and special effects benefit from the unsurpassed (in the PCs space, at least) power of these chips to execute both integer and floating-point (FP) calculations quickly.

If you want a dual-processor system (say, for an entry-level server), the Pentium III or Xeon is your only choice for now; dual-processor Athlon systems won't emerge until next year. But you'll want to keep Athlon in mind: Our testing of single-

CPU systems shows that, cycle for cycle, the Athlon outperforms the Pentium III by a respectable margin under Windows NT.

PROFESSIONAL/ENTHUSIAST

If you don't quite need a PC workstation but your work involves image editing, high-end desktop publishing, video work, or Web site creation, then you, too, are a candidate for an Athlon- or Pentium III-based system. If you are a PC enthusiast—a serious gamer or someone who dabbles in technology for technology's sake—then Athlon or Pentium III is the right path for you, too.

SMALL BUSINESS

If running your business entails calculation-intensive accounting tasks, Web-site creation, and video work, you'll want an Athlon or Pentium III system. But most users won't need that kind of power. If the most sophisticated app you run is a desktop publishing program, then a Celeron, AMD K6-2, or Cyrix M II will do the trick.

CORPORATE USER

Most corporate users won't benefit from moving up to a Pentium III or Athlon from a less expensive 300- to 400-MHz Celeron,

PIII AND THE INTERNET: What Is Behind the Blue Door?

In its ubiquitous "behind the blue door" advertising campaign surrounding the release of the Pentium III processor, Intel implied that having a Pentium III system would enhance your Internet experience. So PC Magazine Labs set out to test that claim with respect to how fast Internet-based applications perform on a Pentium III versus a Pentium II.

Our findings: In visiting 18 commercial sites highlighted by the Intel WebOutfitter Web site, we could see little difference in performance between a Pentium II/450 and a Pentium III/450 connected to the Internet via 56K dial-up connections. We visited the sites multiple times over a three-week period, viewing shipping (not beta) content. We did note a few minor improvements in *render quality* and frame rate on a few sites. We also visited many of the same sites using a T1 connection and saw no perceivable performance or quality advantage for the Pentium III.

What the Pentium III and its "blue door" bring to the party that the Pentium II and Celeron do not is the new SSE technology and higher clock speeds. SSE can deliver benefits for advanced graphics—most notably 3-D renderings and 2-D animations—that give users a better sense of realism. Sites such as Autobyte.com (www.autobyte.com) and Warner Bros. Online's store (shopping.warnerbros.com) use various plug-ins or controls—supplied on the Intel WebOutfitter CD (which Pentium III owners may obtain free from the Intel WebOutfitter Web site) or by plug-in vendors—including Macromedia Flash 4 and Shockwave 7, MetaCreations MetaStream, and the Pulse Entertainment Pulse 3D Player.

We assume that most of these plug-ins are SSE-enhanced. Users who visit these enhanced sites (and others, with more on the way) with a Pentium III machine will, the theory goes, have a better Internet experience, implying that sites viewed with a Pentium III will display content faster or provide richer content, or both. At least that's what one would infer. But in PC Magazine Labs, we saw little difference. Our testing, however, did show a decided speed advantage for SSE-enabled desktop-resident applications. The Twirl filter in Adobe Photoshop, for instance, showed an impressive 30 percent performance improvement when we moved from a Pentium II/450 to the Pentium III/450. Our own ZD 3D WinBench 99 Transform and Lighting test showed marked improvement—up to 60 percent—from the Pentium II to the Pentium III. On a Caligari trueSpace4 SSE demo, the Pentium III showed a nearly threefold improvement over the Pentium II.

So although SSE's advantages can be seen in certain applications, we remain unconvinced of its benefit to typical Web surfers today—though that could change in the future. It may take Web sites with more advanced graphics capabilities to utilize SSE to the fullest. For example, we experienced an impressive downloadable SSE beta demo from blaxxun Interactive (www.blaxxun.com) using 3-D objects based on NURBS technology that showed up to a 2:1 performance improvement on the Pentium III when scaled to high levels of polygonal complexity. As such technologies become more mainstream, the benefits of SSE could really shine.—*Jamie M. Bsaies and Nick Stam*

Pentium II, or K6-2, at least not according to our test results. Typical business apps don't take advantage of the performance boosters in the higher-end chips.

HOME USER

If you are a typical home user—browsing the Internet, managing your finances, and playing a few games—nearly any processor will do the job. AMD's K6 family, Cyrix's M II, and Intel's Celeron and Pentium II will prove perfectly adequate. The exception: If you like to play sophisticated 3-D games, spring for an Athlon or a Pentium III processor. The increased performance can significantly boost the realism of advanced games.

MOBILE USER

While the Athlon and Pentium III are not yet available in mobile configurations, the range of available processors should prove choice enough. If you need a fairly powerful machine to serve as your only system, look for a relatively high-speed Mobile Pentium II or Mobile Celeron machine (up to 400 MHz). If cost is a con-

cern, specify a slower Mobile Pentium II or Celeron, or an AMD K6-2 CPU.

PENTIUM III



PROS: Fast, scalable.

CONS: Expensive.

BOTTOM LINE: The right choice for performance-oriented users skittish about AMD.

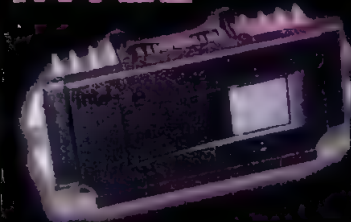
||| The big news about Intel's latest high-end chip can be summed up in three letters: SSE. In fact, the only substantive difference between the Pentium III and its Pentium II predecessor (which Intel will discontinue at year's end) are these Streaming SIMD (single instruction, multiple data) Extensions and higher clock speeds.

The "Streaming" in SSE refers to instructions that expedite the transfer of long streams of data to and from memory. Hence, the value of these instructions is not limited to 3-D and multimedia; they

can speed up any program that accesses large data sets, such as database managers.

SSE also contains a few instructions, called *new media instructions*, that are essentially extensions of MMX. These instructions use the same set of registers as the MMX instructions and, like the MMX instructions, perform integer computations. They speed up video processing (such as software-based MPEG-2 encoding) and speech recognition engines.

INTEL



(Prices as of June 1999, in lots of 1,000)

Intel Celeron/333	\$67
Intel Celeron/400	\$83
Intel Celeron/466	\$147
Intel Celeron/500	\$187
Intel Pentium II/450	\$268
Intel Pentium III/450	\$268
Intel Pentium III/500	\$482
Intel Pentium III/550	\$658
Intel Pentium III/600	\$689
Intel Pentium III Xeon/550	\$931

Our Contributors: MICHAEL SLATER is the principal analyst at MicroDesign Resources (www.mdronline.com) and the executive editor of *Microprocessor Report*. RICH FISCO was the project leader, and senior associate editor JAMIE M. BSALES was in charge of this story.



PII



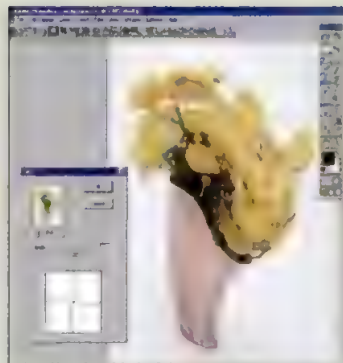
PIII

None

▲ **INTERNET PERFORMANCE:** In side-by-side testing of a Pentium II/450 and Pentium III/450, we could detect no visible speed and only minor quality differences.

30%

► **DESKTOP APPLICATIONS:** In certain desktop-resident applications, the Pentium III's SSE technology does deliver measurable benefits. For instance, we measured a 30 percent performance improvement in rendering speed using the Twirl filter in Adobe Photoshop.



The SIMD instructions in SSE can significantly improve the performance of 3-D geometry and lighting calculations. This part of the 3-D task is not typically performed by the graphics accelerator chips available today (though that will change next year), so SSE is complementary to—not competitive with—accelerator chips. It's important to stress that, as with MMX, SSE improves performance only when software is modified to use the new instructions.

The value of SSE showed up clearly on some of our tests and not at all on others. On ZD 3-D WinBench, a 450-MHz Pentium III beat a 450-MHz Pentium II by 62 percent on the Transform and Lighting task. Using Adobe Photoshop with the Twirl filter applied, the Pentium III bested its predecessor about 30 percent. By contrast, under ZD Business Winstone 99, which does not benefit from SSE, the Pentium III showed no advantage over the Pentium II.

The Pentium III family also includes the Xeon processor. The main difference: The Xeon has a faster and larger L2 cache (up to 2MB) than the standard Pentium III, which makes it better suited for multiprocessor servers, where the large caches reduce bus usage and provide better multiprocessor scaling; and

for systems that use large working sets, such as database engines. Our testing showed little performance advantage in typical PC applications.

This fall, a new version of Pentium III, code-named Coppermine, will debut. Built using Intel's most advanced semiconductor process—an 0.18-micron design—Coppermine should scale to higher clock speeds. Intel is having trouble achieving the speeds it expected, however, and it recently delayed the chip's launch (in the desktop version) from September to November. It is, however, expected to

hit speeds of at least 667 MHz (with a 133-MHz bus). In the meantime, Intel has launched a 600-MHz Pentium III based on the original 0.25-micron Pentium III.

Coppermine will include 256K of on-chip L2 cache that will run at the full speed of processor. Initially, Coppermine probably will be sold on a Slot 1 module, just like today's Pentium III, to maintain motherboard compatibility. In time, however, all of Intel's processors are likely to move to a pin-grid-array socket similar to that used for the Celeron (the so-called Socket 370).

AMD ATHLON



PROS: Faster, cheaper than the Pentium III

CONS: Not all SSE instructions supported; no dual-processor support yet; AMD's spotty delivery history.

BOTTOM LINE: A real alternative—if AMD can keep its act together.

► AMD made a name for itself with its K6 family of processors, low-cost alternatives to the Intel Pentium II and Celeron that helped create the sub-\$1,000 PC market. AMD's latest offering, the Athlon (known as the K7 while in development) changes the game entirely. Although the exact advantage depends on the test, the bottom line is clear: AMD is no longer just a supplier of inexpensive alternative processors but also the source of the fastest x86 processor you can get.

The Athlon is based on an entirely new processor core. Like the Pentium II and

PC EDITORS' HOT LINKS

www.pcmag.com/hotlinks
Microprocessors are amazing, complex devices. Visit these sites for insights into the world of chips and chip sets:

► **Microprocessor Report: PC Processor Architecture**
www.mdronline.com/x86/microarchitecture
This site provides excellent technical details of the basic chip architecture present in

current chips, as well as offering industry news, editorials, and a library.

► **Intel WebOutfitter Home Service**
<http://intelweboutfitter.com>
This Web site was created specifically for those people who already own a Pentium III-based PC. WebOutfitter offers the latest plug-ins and add-ons.

► **Intel Developer Site**
<http://developer.intel.com>
Technical information on Intel chips, chip sets, and platform initiatives and technologies.

► **Dr. Dobb's Microprocessor Center**
www.x86.org/
Microprocessor headline news, errata, and—oh!—Intel secrets.

► **AMD K6 Technical Documentation**
www.amd.com/K6/k6docs/index.html
Information includes data sheets and technical manuals. You can subscribe to receive future updates.

CPU_s ON THE HORIZON

FALL 1999

Intel will introduce Coppermine, a new version of the Pentium III. Built on a 0.18-micron process, the chip will include 256K of on-chip L2 cache that runs at the speed of the processor. It will first appear as a mobile CPU in September at a speed of 500 MHz. November will see the desktop version, likely to run at 667 MHz with a 133-MHz bus. Cascades, a server version of Coppermine, is due in late 1999 with more L2 cache and different packaging.

Cyrix will introduce Gobi. Its CPU core, code-named Cayenne, will be based on the M II core but will add faster floating-point operations, MMX units, and 3DNow! instructions as well as 256K of on-chip L2 cache.

AMD will release a 0.18-micron version of Athlon.

EARLY 2000

Mojave, Cyrix's next-generation CPU, will debut—as long as the company's acquisition by VIA Technologies doesn't change any plans.

MID-2000

Merced, Intel's first IA-64 processor, is scheduled to ship. Built using a 0.18-micron process, the CPU will debut at about 800 MHz and will execute 6 to 8 instructions per cycle.

FALL 2000

Willamette, Intel's seventh-generation processor, will be built using a 0.18-micron process and is promised to deliver both higher clock speeds and higher performance per clock cycle than the Pentium III. Foster, the server version, will follow.

MID-2001

McKinley, Intel's second IA-64 processor, should be twice as fast as Merced, using the same 0.18-micron process, and is likely to be the chip that gives IA-64 its real start. But IA-64 CPUs won't have any role in PCs until a low-cost derivative of McKinley, code-named Deerfield, is introduced in 2002.

Pentium III, the Athlon is mounted in a module with separate SRAM chips for the L2 cache, and it has a special bus that connects the processor to the L2 cache chips. Also as with Intel's current processors, the L2 cache is 512K, and the interface runs at one-half of the processor's clock speed.

The Athlon design, however, has a number of advantages over the Pentium III's. It has four times as much total L1 cache as the Pentium III. The chip can decode any three x86 instructions at a time, whereas Intel's chip can decode three instructions only if two of the three are simple instructions that translate to a single internal operation. The Athlon can dispatch up to nine internal instructions per clock cycle to its execution units, compared with the Pentium III's five. And unlike previous AMD processors, the Athlon is no slouch when it comes to floating-point and MMX instructions. Pentium III can execute a floating-point multiply every other cycle *or* a floating-point add every cycle; the Athlon can issue both a floating-point multiply *and* a floating-point add every cycle.

These microarchitectural advantages mean higher performance for integer-based business application and server processing, and floating-point-intensive workstation and gaming applications. The Athlon's advantages showed themselves well on our benchmark tests. The 600-MHz Athlon was 4 percent faster than a 600-MHz Pentium III on ZD Business Winstone 99; 27 percent faster on ZD CPUmark 99 (integer CPU calculations); 8 percent faster on ZD FPU WinMark 99; and 2 percent faster on ZD 3D WinBench 99.

The Athlon/600 also beat the Intel Pentium III Xeon/550 with both processors running Windows NT. The Athlon was 16 percent faster on ZD High-End Winstone 99, 14 percent faster on Business Winstone, and 26 percent faster on ZD CPUmark 99. Thus, the Athlon is a strong offering for workstations and entry-level servers as well as for PCs.

One major source of concern about the Athlon is its lack of SSE. To counter such concerns, AMD's new Enhanced 3DNow! technology provides equivalent functions and AMD also added a few new instructions to speed up digital signal processing

tasks, such as MP3 audio decoding. We expect to see many games optimized for both environments, but in the meantime, users will have to check their favorite applications to see which scheme is supported.

Another concern, for PC makers at least, is the immediate availability of Athlon-ready chip sets and motherboards. The Athlon requires entirely new chip sets and motherboards because the Athlon bus runs at 200 MHz and uses a totally different design. At 200 MHz, the Athlon bus is twice as fast as today's Pentium III bus and 50 percent faster than the 133-MHz bus Intel will launch this fall. While the performance benefit of the faster bus is minimal in the initial Athlon systems since a typical memory system today runs at 100 MHz, the fast bus gives AMD lots of headroom. Future high-end chip sets could support two banks of SDRAM memory, or they could use Direct Rambus memory, either of which will be able deliver data faster than Intel's 133-MHz bus can transfer it.

Most of the early Athlon systems will use AMD chip sets. ALi, SiS, and VIA, however have all signed up to produce Athlon chip sets. In addition, because Athlon uses the same bus as the Alpha 21264 processor, multiprocessor chip sets being developed by Alpha Processor will also support the Athlon. Furthermore, a start-up called HotRail is developing a multiprocessor chip set for the Athlon.

INTEL CELERON



PROS: Affordable; fast enough.

CONS: No SSE (yet).

BOTTOM LINE: A good bet for all but the most power-hungry users.

Where home and corporate buyers are concerned, the biggest development in the past year has been Intel's newfound commitment to the low-cost PC market. The first Celeron chip (released in spring 1998) had no L2 cache and was a performance dog. Buyers (especially business users) balked, and Celeron became the chip non grata. It wasn't until the late-1998 launch of the Celeron processor with on-

SUMMARY OF FEATURES

See www.pcmag.com for interactive views.

Comparing the CPUs

■ YES □ NO	AMD K6-2	AMD K6-III	AMD Athlon	Cyrix M II	Intel Pentium II	Intel Celeron	Intel Pentium III	Intel Pentium III Xeon
Introduction date	May 1998	February 1999	August 1999	April 1999	May 1997	April 1998	February 1999	March 1999
Clock speeds (MHz)	300, 333, 350, 366, 380, 400, 450, 475	400, 450	500, 550, 600, 650	250, 285, 300	233, 266, 300, 333, 350, 400, 450	266, 300, 333, 366, 400, 433, 466, 500	450, 500, 550, 600	500, 550
Level 1 (L1) data and instruction caches	32K, two-way set associative	32K, two-way set associative	64K, two-way set associative	64K, four-way set associative	16K, four-way set associative	16K, four-way set associative	16K, four-way set associative	16K, four-way set associative
Level 2 (L2) cache sizes	512K, 1MB, 2MB	256K	512K	None	512K	128K	512K	512K, 1MB, 2MB
Level 3 cache sizes	None	512K, 1MB, 2MB	None	None	None	None	None	None
Memory bus speed	100 MHz	100 MHz	100 MHz	95 MHz, 100 MHz	66 MHz, 100 MHz	66 MHz	100 MHz	100 MHz
Memory bus bandwidth	800 MBps	800 MBps	800 MBps	760 MBps, 800 MBps	800 MBps	533 MBps	800 MBps	800 MBps
Physical number of data bus pins	64	64	64	64	64	64	64	64
Physical number of address bus pins	32	32	36	32	36	36	36	36
Maximum physical memory addressability	4GB	4GB	64GB	4GB	64GB	64GB	64GB	64GB
Maximum x86 instructions decoded per clock cycle	2	2	3	2	3	3	3	3
Number of MMX units	2	2	2	1	2	2	2	2
SIMD units	MMX, 3DNow!	MMX, 3DNow!	MMX, 3DNow!	MMX	MMX	MMX	MMX, SSE	MMX, SSE
SIMD registers (number/size)	8 / 64 bit	8 / 64 bit	8 / 64 bit	None	8 / 64 bit	8 / 64 bit	MMX: 8 / 64 bit SSE: 8 / 128 bit	MMX: 8 / 64 bit SSE: 8 / 128 bit
Memory read and write streaming	■	■	■	□	□	□	■	■
Pipelined floating-point units	□	□	■	■	■	■	■	■
Current process technology	0.25-micron, 5-layer metal	0.25-micron, 5-layer metal	0.25-micron, 6-layer metal	0.18-micron, 5-layer metal	0.25-micron, 5-layer metal	0.25-micron, 5-layer metal	0.25-micron, 5-layer metal	0.25-micron, 5-layer metal
Current die size	81 mm ²	119 mm ²	184 mm ²	62 mm ²	131 mm ²	153 mm ²	128 mm ²	128 mm ²
Total number of transistors	9.3 million	21.3 million	22.0 million	6.5 million	8.8 million	19.0 million	9.5 million	9.5 million
Packaging	Socket 7/ Super7	Socket 7/ Super7	Slot A	Socket 7/ Super7	Slot 1	Slot 1/ Socket 370	Slot 1	Slot 2
Scalable to how many processors	1	1	1 (support for more expected in 2000)	1	2	1	2	8

chip L2 cache—code-named Mendocino—that Intel's offerings became competitive with the low-cost processors from AMD and Cyrix.

The Celeron processor takes the same processor core that is in the Pentium II and adds 128K of on-chip L2 cache that runs at full processor speed. By contrast, the Pentium III has a larger 512K cache, but it is off-chip and thus runs at one-half of the processor speed. Consequently, the Celeron's performance is much closer to that of a Pentium III than the four-to-one difference in cache size might suggest.

In fact, for many applications, a Celeron processor is nearly as fast as a Pentium III at the same clock speed. For example, our ZD Business Winstone 99 tests showed that a Celeron/500 delivered the same performance as a Pentium III/450, while a Celeron/466 trailed the Pentium by only 3 percent.

Of course, if the L2 cache were the only difference between Celeron and Pentium III, there would be very little reason for PC

makers to pony up as much as \$300 more per chip for Pentium III. To maintain greater differentiation, Intel has limited Celeron's bus speed to 66 MHz, whereas Pentium III processors use a 100-MHz bus.

AMD K6 FAMILY



PROS: Affordable; fast enough.

CONS: MMX and FPU performance are below that of Intel CPUs, and K6-2 (not K6-III) falls short on integer performance as well.

BOTTOM LINE: A perfectly acceptable choice, especially for home users. Also a good choice for corporate users, who rarely have any need for MMX or floating-point performance.

AMD has made a huge impact with its K6-2 processor, especially in the U.S. retail market, where AMD's share is neck and neck with Intel's, according to InfoBeads, Ziff-Davis's market-research service. This chip has also been successful

in the "white box" business PC market (systems sold by system integrators under their own brand) and is used in some direct-channel PCs as well. The K6-2 also rocketed to a greater than 40 percent share position in the U.S. retail market for notebook computers, though its share

AMD

(Price as of July 1999, in lots of 1,000)

AMD K6-2/400	\$82
AMD K6-2/450	\$112
AMD K6-2/475	\$152
AMD K6-III/400	\$185
AMD K6-III/450	\$220
AMD Athlon/600	\$699

MOBILE PROCESSORS

Mobile processors present a unique set of design challenges. Foremost is the power consumption issue. Low power consumption is desirable because it aids long battery life; it also produces less heat in an environment where heat dissipation is a problem. As a result, mobile processors typically operate at a lower supply voltage, use different packaging, and run at lower clock speeds than their desktop brethren.

For example, the Pentium II in its original form could reach a speed of only 300 MHz in the mobile environment because of power dissipation limits. To exceed this, Intel created a chip, code-named Dixon, that has 256K of on-chip L2 cache. (You can think of this chip as a Celeron processor with twice as large a cache. Because it performs like a Pentium II, however, Intel markets it as such, rather than as a Celeron.)

Intel has recently begun shipping a 0.18-micron version of Dixon; it is the first chip to use this process, and it operates at

a slightly lower voltage than the 0.25-micron version. Intel offers both 0.18-micron and 0.25-micron Mobile Pentium II processors at 400 MHz; the 0.18-micron version consumes less power but costs a little more. The mobile Celeron processor is actually the same Dixon chip with half of its cache disabled.

The 0.25-micron Pentium III is too power-hungry for the mobile environment. The 0.18-micron Coppermine version of the Pentium III will appear as a mobile processor (due this fall) first at a clock speed of 500 MHz; it will include 256K of on-board L2 cache and SSE. Faster versions will be delayed because of the same speed problems that have delayed the desktop Coppermine.

AMD offers mobile versions of both the K6-2 and the K6-III. AMD's mobile processors typically consume more power than Intel's do, but the reduction in battery life is modest, and the cost savings can be considerable. —MS

of corporate notebooks remains small.

The K6-2 uses the Socket 7 bus—the interface Intel defined for its older Pentium processor—but runs the bus at 100 MHz instead of the 66 MHz Intel used. AMD calls systems using this bus, which typically also have AGP, the Super7 platform.

Unlike Pentium II and Pentium III, the K6-2 does not have a separate interface for the L2 cache, so the cache speed is limited to 100 MHz and must share the bus bandwidth with memory and I/O traffic.

Thus as clock speeds increase, its performance does not rise as steeply as that of the Intel processors. The AMD K6-2/475, for example, scored only 3 percent above the K6-2/400 on our ZD Business Winstone 99 tests, whereas the Intel Celeron/466 beat the Celeron/400 by almost 7 percent. And tick for tick, the Celeron tended to outpace the K6-2 by 5 to 10 percent. The K6-2 processor also has slower floating-point and MMX units than Intel's chips, so its performance fell further behind on many 3-D, image processing, and multimedia applications.

AMD's follow-up, the K6-III, debuted in early 1999. It added an on-chip, 256K L2 cache, providing a significant performance boost. For example, a 450-MHz K6-III was 21 percent faster than a 450-MHz K6-2 on ZD Business Winstone 99.

And the K6-III/400 performed about 11 percent better on Business Winstone 99 than a Celeron/400.

Nevertheless, systems based on the K6 III are relatively rare for two reasons: semiconductor economics and retail PC buyer behavior. The on-chip L2 cache makes the chip much larger, which both increases the cost of manufacturing and decreases the number of chips AMD can produce given its capability. At the same time, PC buyers look at clock speed more than benchmark test performance.

CYRIX M II



PROS: Affordable; adequate for low-end machines.

CONS: Sale of the company may make PC makers wary.

BOTTOM LINE: Worth considering for a budget-priced home machine.

▶ The Cyrix M II was quite successful in the low-cost PC market in 1998, especially in the least expensive systems. As Intel became more aggressive with Celeron prices and clock speeds, though, Cyrix's market share plummeted. National Semiconductor, Cyrix's parent company, decided in May to exit the PC proces-

sor market and put Cyrix up for sale. As of this writing, the sale of Cyrix to chip set maker VIA Technologies is pending.

Unlike AMD's chips, the M II is rated by its "equivalent performance," not its clock speed; the M II/433 actually runs at 300 MHz. Our tests showed that it didn't quite live up to this rating; on ZD Business Winstone 99, the M II/433 scored about 5 percent lower than its closest competitor, AMD's K6-2/400, and 8 percent lower than Intel's Celeron/400. It fell much farther behind on tasks that make extensive use of floating-point or MMX functions.

The M II design is clearly showing its age, and Cyrix plans to replace it this fall with a chip code-named Gobi. This new device uses an enhanced M II-based CPU core, code-named Cayenne, and adds faster floating-point and MMX units and 3DNow! instructions. In addition, the Gobi will include a 256K on-chip L2 cache, which will run at full processor speed. Gobi also marks a shift from the Socket 7 bus; it will be the first non-Intel chip to use the P6 bus and plug into the same socket as a Celeron.



IT'S A BUYERS MARKET

With its Celeron and Pentium III lines, Intel covers both the low-cost and the high-performance ends. AMD's K6-2 is a strong offering for home systems, and Cyrix's M II is acceptable as long as 3-D and multimedia performance aren't critical. The most exciting new part, however, is AMD's Athlon, giving performance-driven buyers a new alternative. The PC processor business remains challenging for Intel's competitors, but for PC buyers, the competition has increased choices and lowered prices.

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PERFORMANCE TESTS

CPUs



For the first time, Intel wasn't the performance leader in the x86 processor field: The AMD Athlon beat the Pentium III in raw performance for both integer and floating-point operations, and won in nearly all aspects of processor performance.

We ran ZD Business Winstone 99 under both Windows 98 and Windows NT 4.0 to show integer performance while running real applications. Intel's best offerings, the Pentium III/550 and Pentium III/600, did well—but AMD's Athlon/550 and 600 did better, beating their Pentium III counterparts by 3 and 4 percent, respectively, under Windows 98. As the only 650-MHz chip in this review, the Athlon/650 added to the lead over Pentium III.

Intel also offers the Pentium III Xeon, which is marketed mainly as a workstation and server processor. The 550-MHz Xeon with 512K of full-speed L2 cache virtually tied the Athlon/550, but the 650-MHz Athlon was slightly faster than the Xeon. While Xeon matched similarly clocked Athlons in Business Winstone scores, it lagged behind on almost every other test.

We made an interesting discovery relating to typical PC usage: If you use your PC mostly for running a word processor, spreadsheet, Internet browser, and other common business applications, then you can look at the Pentium II/450, Intel Celeron/500, K6-III/400, and Pentium III/450 as nearly identical processors. Thus, buying systems with less expensive CPUs frees you to spend the extra money on sufficient memory, a good 3-D graphics card, and a fast hard disk.

We also ran Business Winstone under Windows NT 4.0 with 256MB of RAM, and we focused our comparison on the 550-MHz Xeon versus the 600-MHz Athlon. The Athlon/600 beat the

Xeon here by 14 percent.

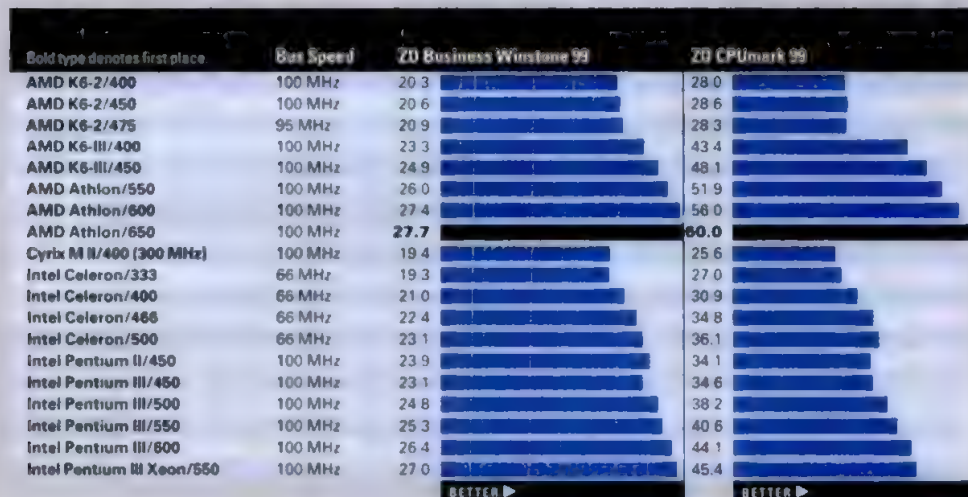
Our ZD High-End Winstone 99 tests compare integer performance running mostly high-end 2-D workstation-class applications under Windows NT. The results once again put the Athlon at the top.

For measuring integer CPU performance, we used ZD CPUmark 99. AMD took the top five spots, with the Athlon leading the way. The best Cyrix has to offer, the M II/400, is performance-rated and actually runs at 300 MHz. Its integer performance is comparatively poor, so it took last place in this field.

We used our synthetic ZD FPU WinMark to measure the floating-point capabilities of the processors. Long the Achilles' heel of all x86 processors, the P6 architecture processors (Pentium Pro, Pentium II and III) are far superior to the Pentium. But the floating-point performance of AMD's Athlon is even better. The Athlon/550 and 600 each beat the Pentium IIIs with the same speeds by 8 percent, while the Athlon/650 bested the Pentium III/600 by nearly 17 percent. Note that the Celeron didn't falter here. Based on the same core as the Pentium III, the Celeron is equal or even superior in floating-point performance, mostly because of its full-speed L2 cache and the fairly small working set of the floating-point-test applications: The Celeron/500 beat the Pentium III/500 by almost 5 percent.

Other than the Athlon, the competitors didn't compare well with Intel chips. The Celeron chips consistently outperformed AMD's K6-III offerings at each MHz level. And Cyrix makes no pretense about its floating-point performance; its score was less than one-fifth that of the top-performing Athlon/650.

We ran our ZD 3D WinBench 99 test suite. For the overall 3D WinMark score, the Athlon/600 processor topped the Pentium III/600 processor by a few percentage points. We also present the 3D Transform and Lighting subtest results, to help show floating-point performance. We present results of testing with guardband off and with guardband on. The guardband is an overflow area beyond the actual screen area to be rendered. Some applications use the guardband area to reduce the number of triangles that



◀ The AMD Athlon/650 was the ZD Business Winstone 99 winner, beating both the Pentium III/600 and the Xeon/550 by narrow margins. For those who can't afford an Athlon-based system, our tests showed that the Pentium II/450, Celeron/500, K6-III/450 and Pentium III/450 all performed equally well on basic business applications.

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PERFORMANCE TESTS

▲ High scores are best. ▼ Low scores are best. Bold type denotes first place.		Floating-Point Tests		
	Bus speed	ZD FPU WinMark 99 ▲	ZD 3D WinMark 99 ▲	Photoshop: Twirl (seconds) ▼
AMD K6-2/400	100 MHz	1,330	695	18
AMD K6-2/450	100 MHz	1,500	717	17
AMD K6-2/475	95 MHz	1,570	718	16
AMD K6-III/400	100 MHz	1,350	735	18
AMD K6-III/450	100 MHz	1,520	762	16
AMD Athlon/550	100 MHz	2,990	1,050	12
AMD Athlon/600	100 MHz	3,260	1,060	11
AMD Athlon/650	100 MHz	3,540	1,070	10
Cyrix M II/433 (300 MHz)	100 MHz	670	489	32
Intel Celeron/333	66 MHz	1,770	783	21
Intel Celeron/400	66 MHz	2,120	850	18
Intel Celeron/466	66 MHz	2,480	886	16
Intel Celeron/500	66 MHz	2,660	899	15
Intel Pentium II/450	100 MHz	2,280	923	15
Intel Pentium III/450	100 MHz	2,280	985	11*
Intel Pentium III/500	100 MHz	2,540	1,010	10*
Intel Pentium III/550	100 MHz	2,780	1,020	9*
Intel Pentium III/600	100 MHz	3,030	1,040	8*
Intel Pentium III Xeon/550	100 MHz	2,820	1,040	8*

* This score is with SSE enabled; with SSE disabled, the operation took significantly longer.

▲ While the floating-point performance of the Pentium II and the Pentium III were far better than that of the Pentium, AMD's Athlon was far better still, by 8

percent at the same clock speed. The other CPUs couldn't compete: Celeron chips outperformed K6-III chips of the same speed, and the Cyrix M II couldn't keep up at all.

need to be rendered and clipped—typically CPU-intensive operations.

By default, ZD 3D WinBench 99 tests use no guardband; a larger number of triangles will therefore need to be checked for clipping (and will possibly need to be clipped) than would be the case if the tests used a guardband. Under DirectX 6.x the clip-checking and clipping code for Intel-based processors uses basic x87 floating-point instructions instead of SSE code. But AMD processors benefit from 3DNow! instructions. With guardband off, more CPU work is required—and the AMD processors perform the clipping operations more efficiently. Intel argues that the amount of clip checking and triangle clipping in ZD 3D WinBench 99 with guardband off is excessive, and more than in normal applications, so the company claims it was not necessary to optimize the clipping code in DirectX 6. Still, Intel is optimizing this path in DX7 with SSE, and provided us a DLL, not presently available to the public, that uses SSE clipping operations for DX6, so we could see how much better the Intel chips might perform.

Our Transform and Lighting subtest showed the Athlon to have the most efficient code overall, and especially for handling the added clipping with guardband off. When we used the non-shipping DLL file Intel supplied, Intel's scores on the Pentium III/600 and Pentium III/450 went up 20 percent on the Transform and Lighting test.

We also used Adobe Photoshop 5.0.2 to help measure floating-point performance with the Lighting Effects filter and SSE performance with the Twirl filter. Photoshop's filters take static graphics,

apply the filter, and quickly redraw the image to the screen. We made sure the file sizes were small enough to fit entirely in memory so as not to involve the disk. Since the CPU does the filter calculations and the Lighting Effects filter contains significant FPU code, it's a valuable tool in measuring FPU performance with a real application. The Athlon processors took the top three spots.

To measure the effect of SSE code, we tested the Pentium III/450 and Pentium III Xeon/550 with and without the SSE plugin for Photoshop and used the Twirl filter (which we determined was the best SSE optimized filter in Photoshop). We ran the Pentium II/450 the same way as a control. The Xeon gained over 60 percent, and the Pentium III gained 40 percent. Note that these results aren't for average SSE-enabled software; rather they are for pieces of code that can gain the most from SSE coding.

We used three games from Computer Gaming World's 3D GameGauge 2.0 to test SSE and 3DNow! capabilities. We chose Descent III, PowerSlide, and Expendable; all are both 3DNow!- and SSE-enabled, according to Intel and AMD Web sites. The results were mixed. On both Descent III and Expendable, the Athlon/600 nosed out the Pentium III/600. On PowerSlide, the Athlon/600 was slightly slower than the Pentium III systems.—*Analysis written by Rich Fisco*

How We Tested

To compare processors equally, we tested under Windows 98 Second Edition on test-beds equipped with 128MB of 100-MHz CAS 2 SDRAM (from Kingston Technology), a Diamond Viper V770 Ultra graphics card (with the Version 4.01 driver), and an IBM Deskstar 22GXP hard disk (which has a spin rate of 7,200 rpm). We defragmented the hard disk before each test and let Windows 98 manage virtual-memory settings. For our 2-D tests, we set the screen resolution to 1,024-by-768, true color mode and set the monitor to 85-Hz refresh. For our 3-D tests, we set the resolution to 1,024-by-768, 16-bit-color mode and set the monitor to 85-Hz refresh.

We ran the Athlon 600 and Pentium III Xeon under Microsoft Windows NT 4.0 with Service Pack 4 installed, and installed the TCP/IP stack required for High-End Winstone 99. For Windows NT testing, we installed 256MB of RAM; the other test-bed components were the same as for Windows 98. We set the resolution to 1,024-by-768, true color and set the monitor to 75-Hz refresh.

We used our benchmark test program **ZD Winstone 99, Version 1.1**, to measure integer performance on 32-bit Windows applications. Winstone 99 is divided into two parts: **ZD Business Winstone 99**, which focuses on mainstream applications, and **ZD High-End Winstone 99**, which emphasizes CPU and graphics-intensive applications. We ran the Business Winstone 99 tests under both Windows 98 and Windows NT but ran High-End Winstone under Windows NT only. Business Winstone 99 measures the time a PC takes to execute a set of scripts that exercise eight office-suite Windows 98 applications and an Internet browser. The scripts include switching between a suite application and the

► According to the Intel and AMD Web sites, the games Descent III, PowerSlide, and Expendable are all both 3DNow!- and SSE-enabled. The test results were mixed—and too close for us to pick a clear winner.

Frames per second. Bold type denotes first place.	SIMD technology employed	3D GameGauge Descent III	3D GameGauge PowerSlide	3D GameGauge Expendable
AMD Athlon/600	3DNow!	45	85	53
Pentium III/600	SSE	42	87	51
Pentium II/450	N/A	40	87	45
Pentium III/450	SSE	40	87	46

N/A: Not applicable. This chip does not use SIMD technology.

Yes starts here.

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PERFORMANCE TESTS

MICROSOFT WINDOWS NT TESTS

	ZD High-End Winstone 99	ZD Business Winstone 99	ZD CPUmark 99	ZD FPU WinMark 99	Adobe Photoshop 5.0.2 Twirl (seconds)	Lighting Effects (seconds)
AMD Athlon/600	34.7	40.2	57.2	3,280	22	55
Intel Pentium III Xeon/550	30.0	35.3	45.5	2,820	25*	81*
	BETTER ►	BETTER ►	BETTER ►	BETTER ►	◀ BETTER	◀ BETTER

browser. Business Winstone 99 weights a PC's test timings based on the applications' unit market shares; it derives a composite number and converts that to a relative score. (The score is relative to the performance of a Dell Dimension Pentium MMX/233 with 32MB of RAM, at 1,024-by-768 resolution with 24-bit color, running Windows NT 4.0 with Service Pack 3. The base score is defined as 10.0.) Our High-End Winstone 99 tests measure the time a PC takes to execute a set of application scripts that exercise seven Windows NT applications. High-End Winstone 99 weights a given machine's seven timings equally, derives a composite number, and converts that to a relative score. (The score is relative to the performance of the base machine above, with a base score of 10.0.)

ZD WinBench 99, Version 1.1, measures a system's graphics, disk, processor, CD-ROM, full-motion video, and DirectDraw performance under Windows 98. Like our Winstone test program, **ZD Graphics WinMark 99** and **ZD Disk WinMark 99** are each divided into business and high-end suites.

ZD CPUmark 99 is a processor-subsystem benchmark test that lets us measure the speed of the processor subsystem, which includes the CPU, RAM, and RAM cache. CPUmark 99 emulates the CPU activity of the real-world 32-bit applications used in Business Winstone 99. Key characteristics emulated are the instruction mix, percentage of L2 cache misses, and branch prediction algorithms used in today's processors. CPUmark 99 closely matches the mix of instructions in Business Winstone 99's applications. CPUmark 99 has a large memory footprint, and its cache characteristics are representative of modern applications. The applications in Business Winstone 99 do not use floating-point or MMX instructions, so CPUmark 99 does not either.

Ed Henning, director of ZD Labs, Europe, developed our **ZD FPU WinMark** test, which consists of five algorithms to solve Poisson's equations, fast Fourier transform (FFT), calculation of planetary orbitals, calculation of areas of polygons, and a Gauss-

▲ Impressed by the Athlon's performance under Windows 98, we put it and the 450-MHz Xeon to further tests with Windows NT. The 600-MHz Athlon was the

clear winner on every test. For example, the Athlon beat the Xeon on our ZD Business Winstone 99 benchmark test by 14 percent.

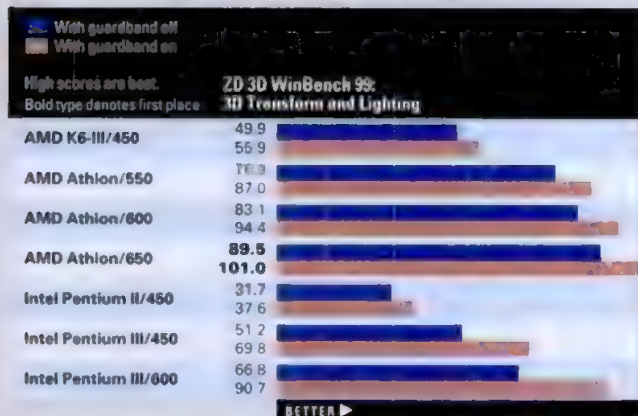
Jordan elimination-of-coefficient matrix of linear equations. The algorithms are weighted to reflect real-world usage and yield a single score.

We used **ZD 3D WinBench 99** to evaluate 3-D graphics performance and to assess a system's ability to execute certain 3-D rendering features. We first performed the **3D Quality** test to determine which of the tested features the graphics card supports. We then ran the performance portion of 3D WinBench 99 to obtain the **3D WinMark 99** score. The test suite is made up of 15 scenes; each scene is rendered by hardware if the 3D Quality test found that the graphics card supported all the scene's 3-D options. If not, the scene is not rendered. On each system, we used the default install of DirectX 6.1a, available only in Windows 98 SE. We also ran the **3D Transform and Lighting** test. This test uses a null driver and does not render any output to the screen during the test. This measures the CPU's ability to handle the floating-point-intensive geometry and lighting tasks without adding in the graphics card's 3-D rendering engine. For certain processors, we ran the Lighting and Transformation test both with the guardband on and with it off (the default for the test).

We also obtained a DLL file from Intel for test purposes. The file is an internally developed DX6 DLL with more optimized clipping code. As described above, this code was developed by Intel to show the effects of SSE optimization of clipping code. Intel is currently working with Microsoft Corp. to get this code into DX7.

We used **Adobe Photoshop 5.0.2** and ran the **Twirl** filter to determine SSE performance and the **Lighting Effects** filter to determine FPU performance. Both filters were tested with the screen set to 1,024-by-768, true color. We maximized the Photoshop window, closed all palettes, and turned on the status bar for all tests. We waited until all disk activity stopped before running each test. We applied Photoshop's Twirl filter using a 25MB TIFF file. We used the default settings of Size—100 percent and Angle—50 degrees. For the Pentium II/450 and the Pentium III/450, we ran the Twirl filter both with and without Adobe's plug-in for SSE enhancement. For all other processors, we ran the filter without the plug-in. We applied Photoshop's **Lighting Effects** filter to a 15MB file with the following settings: Preview—not selected, Style—RGBLight; Light Type—Spotlight, with the checkbox for On selected; Intensity, Focus, Glass, Exposure, Ambiance, and Height—100; Material—Plastic (a value of minus-100); and Texture Channel—Red.

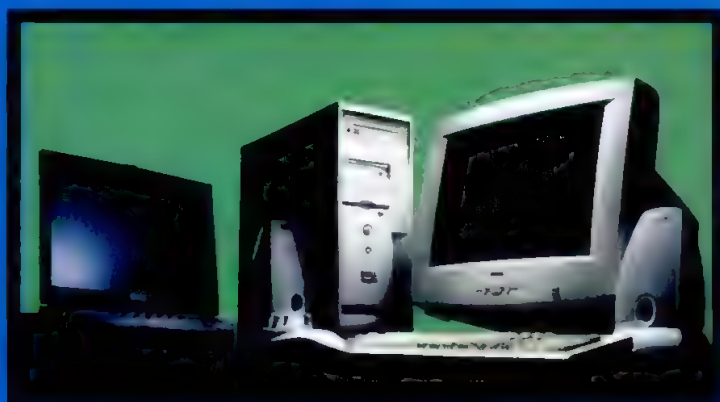
We also used three games from our sister publication Computer Gaming World's **3D GameGauge 2.0** suite to test 3-D game performance. The games we tested with Descent 3, PowerSlide, and Expendable, are all 3DNow!- and SSE-enabled. We ran all tests at 1,024-by-768, true-color mode. [E]



▲ The Transform and Lighting subtest of ZD 3D WinMark 99 showed the Athlon to have the most efficient code overall. The

Athlon was particularly strong when handling the added clipping that occurs when guardband is off.

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- NEW Pentium® III Processor at 600MHz
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- 17" (16.0" vis) M780 Monitor
- NEW 32MB Diamond Viper V770D Graphics Card
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- Sound Blaster Pro Compatible Sound
- Integrated 3Com® Fast EtherLink™ XL 10/100 PCI NIC with Remote Wakeup
- Remote Client Manageability Support via DMI 2.0
- MS® Windows NT® Workstation 4.0
- Logitech First Mouse™
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

\$2599

Business Lease¹⁵: \$87/Mo., 36 Mos.

 **E-VALUE CODE: 04143-490825**

DELL OPTIPLEX® GX1 450L

Network-Optimized Desktop

- Pentium III Processor at 450MHz
- Opti-Frame Low-Profile Tool-Less Chassis
- Long Product Lifecycles for Network Stability
- 64MB 100MHz SDRAM
- 6.4GB⁴ SMART Ultra ATA Hard Drive
- 17" (16.0" vis, .27dp) M770 Monitor
- 4MB ATI RAGE Pro AGP Graphics
- 40X Max⁵ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- 3Com Fast EtherLink XL 10/100 with ACPI and Remote Wakeup
- Asset Tracking and Remote Diagnostics with Dell OpenManage IT Assistant
- MS Windows NT Workstation 4.0
- 3-Year NBD On-site³ Service
- ★ Call about Our Small Business Series Featuring MS Office 2000 Products

\$1349

Business Lease¹⁵: \$45/Mo., 36 Mos.

 **E-VALUE CODE: 04143-390813**

NEW DELL OPTIPLEX GX100 400L

Network-Optimized Desktop

- Intel® Celeron™ Processor at 400MHz
- Opti-Frame Low-Profile Tool-Less Chassis
- Long Product Lifecycles for Network Stability
- 32MB 100MHz SDRAM
- 4.3GB⁴ SMART Ultra ATA Hard Drive
- 15" (13.8" vis) 800F Monitor
- Intel 3D AGP Graphics
- 3Com Fast EtherLink XL 10/100 with ACPI and Remote Wakeup
- Asset Tracking and Remote Diagnostics with Dell OpenManage IT Assistant
- MS Windows NT Workstation 4.0
- 3-Year NBD On-site³ Service
- ★ Upgrade to 64MB SDRAM, add \$49
- ★ Call about Our Small Business Series Featuring MS Office 2000 Products

\$949

Business Lease¹⁵: \$32/Mo., 36 Mos.

 **E-VALUE CODE: 04143-390809**

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- HP DeskJet 710 All-in-One, add \$499.
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- HP SureStore CD-Writer Plus 7500E, add \$324.
- APC Back-UPS Pro 500, add \$149.
- 3Com Palm III Organizer, add \$207.
- Belkin ExpressBus 7-port USB Hub, add \$88.
- Dragon NaturallySpeaking Preferred (Speech Recognition Software), add \$149.

NEW DELL DIMENSION XPS T600

Cutting Edge Performance, High Value

- NEW Pentium III Processor at 600MHz*
- Mini-Tower Model
- 128MB 100MHz SDRAM
- 13.6GB⁴ (7,200 RPM) Ultra ATA Hard Drive
- 17" (16.0" vis, .26dp) M780 Monitor
- 16MB Diamond Viper nVidia TNT AGP Graphics Card
- 40X Max⁵ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- 3Com 3C905C-TXM 10/100 NIC
- 100MB Iomega Zip BUILT-IN Drive
- MS Office 2000 Small Business plus Bookshelf 2000; McAfee VirusScan
- MS Windows® 98 Second Edition
- MS IntelliMouse®
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service

\$1979

Business Lease¹⁵: \$66/Mo., 36 Mos.

 **E-VALUE CODE: 04143-590819**

DELL DIMENSION XPS T450

High Performance, High Value

- Pentium III Processor at 450MHz
- Mini-Tower Model
- 64MB 100MHz SDRAM
- 13.6GB⁴ Ultra ATA Hard Drive
- 15" (13.8" vis, .26dp) 800F Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics Card
- 40X Max⁵ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- MS Office 2000 Small Business plus Bookshelf 2000; McAfee VirusScan
- MS Windows 98 Second Edition
- MS IntelliMouse
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to 96MB 100MHz SDRAM, add \$49.
- ★ 3Com 3C905C-TXM 10/100 NIC, add \$39.

\$1199

Business Lease¹⁵: \$40/Mo., 36 Mos.

 **E-VALUE CODE: 04143-590811**

DELL DIMENSION L400c

Value-Optimized Desktop

- Intel Celeron Processor at 400MHz
- Micro-Tower Model
- 32MB 100MHz SDRAM
- 4.3GB⁴ Ultra ATA Hard Drive
- 15" (13.8" vis) 800F Monitor
- Intel 3D AGP Graphics
- 40X Max⁵ Variable CD-ROM Drive
- Soundblaster 64V Integrated Sound
- Intel 10/100 Ethernet Controller
- Microsoft® Works Suite 99 with Money 99 Basic; McAfee VirusScan
- MS Windows 98 Second Edition
- Logitech FirstMouse+ Wheel (PS/2v)
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ Upgrade to 64MB SDRAM, add \$59.
- ★ Upgrade to a 6.4GB⁴ Ultra ATA Hard Drive, add \$19.

\$799

Business Lease¹⁵: \$27/Mo., 36 Mos.

 **E-VALUE CODE: 04143-590807**

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- In 1998, Dell desktops and workstations won more than 140 product and service awards. See www.dell.com/awards98 for details. Or browse by product: www.dell.com/products/workstat/awards.htm www.dell.com/products/optiplex/awards.htm www.dell.com/products/dim/awards.htm

Advertised configurations vary from award-winning configurations.

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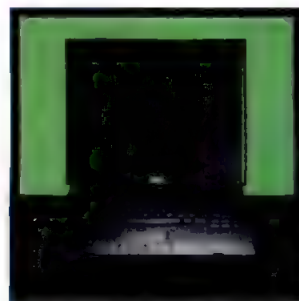
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DELL INSPIRON 7000

Mobile Desktop

- *NEW* Pentium® II Processor at 400MHz
- 15" XGA Active Matrix Display
- 96MB SDRAM
- 14GB⁴ Ultra ATA Hard Drive
- Removable Combo 4X¹⁰ DVD-ROM and Floppy Drive
- 2X AGP 8MB ATI RAGE™ LT Pro 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- 56K Capable¹¹ Gold Card Global Modem with Trial Offer
- ConnectDirect™ Internet Access¹⁴
- Microsoft® Office 2000 Small Business; McAfee VirusScan
- MS® Windows® 98 Second Edition
- Custom Leather Case
- 3-Year Limited Warranty²

\$3579

Business Lease¹⁵: \$121/Mo., 36 Mos.

 **E-VALUE CODE: 04144-890835**

DELL INSPIRON 7000

Mobile Desktop

- Intel® Celeron™ Processor at 366MHz
- 15" XGA Active Matrix Display
- 32MB SDRAM
- 4.8GB⁴ Ultra ATA Hard Drive
- Removable Combo 24X Max⁷ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE LT Pro 3D Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Microsoft Works Suite 99 with Money 99 Basic; McAfee VirusScan
- MS Windows 98 Second Edition
- 3-Year Limited Warranty²

★ Upgrade to 64MB SDRAM, add \$99.

\$1999

Business Lease¹⁵: \$67/Mo., 36 Mos.

 **E-VALUE CODE: 04144-890819**

DELL INSPIRON 3500

Light Weight, Light Price

- Pentium II Processor at 366MHz
- 14.1" XGA Active Matrix Display
- 64MB SDRAM
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM and Floppy Drive
- NeoMagic® MagicMedia™ 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Internal 56K Capable¹¹ v.90 Fax Modem with Trial Offer
- ConnectDirect™ Internet Access¹⁴
- Microsoft Office 2000 Small Business; McAfee VirusScan
- MS Windows 98 Second Edition
- Deluxe Nylon Case
- 3-Year Limited Warranty²

\$2399

Business Lease¹⁵: \$80/Mo., 36 Mos.

 **E-VALUE CODE: 04144-890823**

DELL INSPIRON 3500

Light Weight, Light Price

- Intel Celeron Processor at 366MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM and Floppy Drive
- NeoMagic® MagicMedia™ 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Microsoft Works Suite 99 with Money 99 Basic; McAfee VirusScan
- MS Windows 98 Second Edition
- 3-Year Limited Warranty²

★ Upgrade to 64MB SDRAM, add \$99.

★ Deluxe Nylon Case, add \$39.

★ 3-Year NBD On-site³ Service, add \$99.

\$1799

Business Lease¹⁵: \$60/Mo., 36 Mos.

 **E-VALUE CODE: 04144-890817**

NEW DELL LATITUDE CPi R

Network-Optimized Notebook

- *NEW* Pentium II Processor at 400MHz
- 14.1" XGA Active Matrix Display
- 96MB SDRAM (512MB Max¹³)
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- MagicMedia™ 256ZX
- 3D Surround Sound with Wavetable
- Lithium Ion Battery with 1-Hour ExpressCharge™ Technology
- Microsoft Windows NT Workstation 4.0/Touchpad
- 3-Year Next-Business-Day On-site³ Service

★ Upgrade to 128MB SDRAM, add \$99.

\$3199

Business Lease¹⁵: \$107/Mo., 36 Mos.

 **E-VALUE CODE: 04144-790831**

NEW DELL LATITUDE CPi

Network-Optimized Notebook

- *NEW* Intel Celeron Processor at 400MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM (512MB Max¹³)
- 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- MagicMedia 256ZX
- 3D Surround Sound with Wavetable
- Lithium Ion Battery with 1-Hour ExpressCharge Technology
- Microsoft Windows NT Workstation 4.0/Touchpad
- 1-Year Next-Business-Day On-site³ Service

★ Upgrade to 64MB SDRAM, add \$99.

\$1899

Business Lease¹⁵: \$64/Mo., 36 Mos.

 **E-VALUE CODE: 04144-790818**

DELL NOTEBOOK AWARD INFORMATION

- Inspiron 3500 C300XT – *PC World's* Best Buy in the budget category, 6/99, 7/99.
- Latitude CPi A366XT – *PC World's* #1 Best Buy Power Notebook, 6/99.
- Latitude CPi Series A366XT – *May Windows Magazine* List Fastest Performance, 5/99.
- Inspiron 7000 A366LT – *PC World's* Top 10 Power Notebooks, 4/99.
- Latitude CPi Series 366XT – 5-Time Survivor of *PC Computing's* Annual Torture Test, 3/99.
- Latitude CPi Series D300XT – *PC Computing's* #1 Best Buy Power Notebook, 3/99.
- Inspiron 7000 A366LT – *PC Magazine's* Editors' Choice for small businesses, 2/99.

Advertised configurations vary from award-winning configurations.

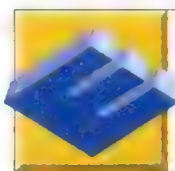
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- HP® DeskJet® 882 Color Printer, add \$299.
- Canon BJC-50 Portable Printer, add \$349.
- Infocus LP 400 Ultra Portable Projector, add \$3025.
- Targus Defcon Security Device, add \$49.
- Auto/Air Power Adapter, add \$99.



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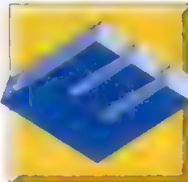
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DELL® POWEREDGE® 6300 SERVER (QUAD PROCESSOR CAPABLE)

Enterprise Class Server

- Pentium® III Xeon™ Processor at 500MHz
- 512MB ECC EDO RAM
- Three 9GB* (10,000 RPM) Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2 with 128MB ECC Cache
- HP® OpenView™ NNM Special Edition
- Two Intel® Pro/100+ PCI Ethernet Adapters with Adaptive Fault Tolerance Software
- Integrated Dual Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 7 Expansion Slots: (4) 64-bit, (3) 32-bit PCI
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- 3-Year NBD On-site³ Service
- 1-Year DirectLine™ NOS Support
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support

\$11,999

Business Lease¹⁵: \$396/Mo., 36 Mos.

 E-VALUE CODE: 04145-290801

DELL POWEREDGE 4300 SERVER (DUAL PROCESSOR/RAID CAPABLE)

Departmental Server

- Pentium III Processor at 500MHz
- 256MB 100MHz ECC SDRAM
- 18GB* Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- HP OpenView NNM Special Edition
- Two Intel Pro/100+ PCI Ethernet Adapters with Adaptive Fault Tolerance Software
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1.6" Hard Drive Bays/4-5.25" Media Bays
- 3-Year NBD On-site³ Service
- 1-Year DirectLine NOS Support
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support
- ★ PowerVault™ 100T 12/24GB Variable SCSI DAT Tape Backup Unit, add \$749.

\$5599

Business Lease¹⁵: \$188/Mo., 36 Mos.

 E-VALUE CODE: 04145-290855

DELL POWEREDGE 2300 SERVER (RAID 5 CONFIGURATION)

Workgroup Server

- Pentium III Processor at 450MHz
- 128MB 100MHz ECC SDRAM
- Three 9GB* Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/Single-Channel
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- Hard Drive Bays: 6-1"
- 4 Media Bays: 3-5.25", 1-3.5"
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support
- ★ APC Smart-UPS 700W Power Supply, add \$369.

\$3999

Business Lease¹⁵: \$134/Mo., 36 Mos.

 E-VALUE CODE: 04145-290839

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- 3Com® OfficeConnect™ Dual Speed Hub 8-port 10/100 TP, add \$239.
- Cisco 1604 Ethernet ISDN Router with NT-1, add \$1502.
- 3Com OfficeConnect 8/TPO, add \$74.
- 3Com Connect TP 800 8-port TP, add \$164.
- 3Com Superstack II Dual Speed Hub 500, 12-port, add \$674.
- HP JetDirect 300x External 10/100 Base TX Printer Server, add \$245.
- 3Com Sportster 56K Capable¹¹ v.90 External Modem, add \$149.
- Princeton 15" Black Monitor, add \$229.
- HP LaserJet® 1100SE, add \$399.
- 3Com OfficeConnect ISDN LAN Modem, add \$406.

DELL POWEREDGE 2300 SERVER (DUAL PROCESSOR/RAID CAPABLE)

Workgroup Server

- Pentium III Processor at 450MHz
- 64MB 100MHz ECC SDRAM
- 9GB* Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- Hard Drive Bays: 4-1.6" or 6-1"
- 4 Media Bays: 3-5.25", 1-3.5"
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support
- ★ Microsoft® Windows NT® Server 4.0 add \$799.
- ★ Upgrade to a Pentium III Processor at 500MHz, add \$300.

\$2449

Business Lease¹⁵: \$82/Mo., 36 Mos.

 E-VALUE CODE: 04145-290824

DELL POWEREDGE 1300 SERVER (DUAL PROCESSOR/RAID CAPABLE)

Entry-Level Server

- Pentium II Processor at 400MHz
- 64MB 100MHz ECC SDRAM
- 9GB* Ultra-2/LVD SCSI Hard Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated PCI Ultra-2/LVD SCSI Controller
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1"
- Media Bays: 3-5.25"
- 3-Year NBD On-site³ Service
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support
- ★ Microsoft Windows NT Server 4.0 add \$799.
- ★ Upgrade to 128MB 100MHz ECC SDRAM, add \$80.

\$1649

Business Lease¹⁵: \$55/Mo., 36 Mos.

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YOUR NETWORK.

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DELL SERVER AWARD INFO

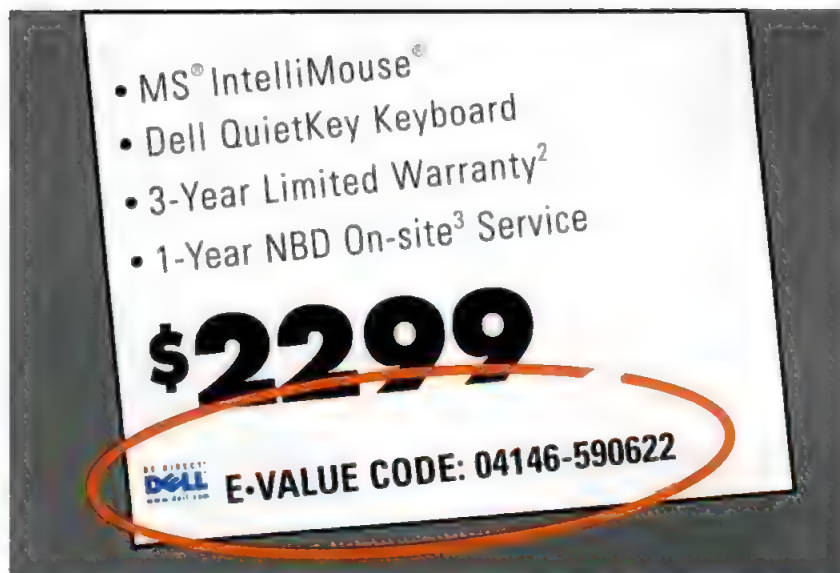
- Network Computing's "50 Best Products of the Year" – Dell PowerEdge 6300 (Enterprise Server), 5/99.
- Network Magazine "1999 Products of the Year" – Dell PowerEdge 2300 (Workgroup Server), 5/99.
- Network World "World Class Award" – Dell PowerEdge 2300, 6/98.
- Computer Shopper "Top 100" – Dell PowerEdge 2300, 11/98.
- PC Computing's "The 'A' List" – Dell PowerEdge 6300, 11/98.
- LANTimes "The Best of LANTimes Over \$25,000" – Dell PowerEdge 6300, 9/98.

Advertised configurations vary from award-winning configurations

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**WEB
AUDIO
& VIDEO**

Surf, Look, & Listen

The times they are a-changin'. The Web has facilitated an audio and video revolution that will forever alter the way we are entertained. **By Jan Ozer**

Think about how you enjoy music, radio, and TV today: stereo rack system, big-screen picture-in-picture TV with cable or satellite at home, portable radio or CD player on the go. Could you really replace all that with a PC and an Internet connection?

Not yet, maybe, but the audio and video revolution on the Web is well under way, and that day is approaching. Downloading near-CD-quality music has been an underground phenomenon that's now going mainstream as controls to protect artists' rights take hold. Streaming audio was one of the earliest forms of Web multimedia, but it, too, is poised to grow as do-it-yourself tools become more accessible—and as major media realize the full power of the Web's ability to break down geographic barriers. Streaming video is perhaps the most embryonic of the three, but as more people have faster

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Streaming Video	133	Where to Go for Your Web Sights and Sounds	122	A Secure Future for Music	148

Where to go for your Web

THE WORLD's largest listening station, radio dial, and video-on-demand service, the Web has what you're interested in, no matter your tastes. Here are 20 of the most notable sites to get you started.

By Eyal Rabinovitch

Format Showcases

a2b Music

www.a2bmusic.com

Although the a2b player was developed for secure online music commerce, the home listener who wants to develop a digital music library will find little help from a2bmusic.com. The pickings are slim: only about a dozen singles from various artists.

Liquid Audio

www.liquidaudio.com

Where a2bmusic.com falls short, Liquid Audio excels. If you can get past the ADD/GenX/Nintendo-inspired eye candy of its design, you'll find a deep selection of liquid music as you slide through this site.

Three artists are featured weekly, plus about 30 additional tracks that you can buy and download directly. The greater payoff comes from the Liquid Music Network, which points you to hundreds of single artist and music sites that offer downloadable songs in Liquid Audio format.

QuickTime Showcase

www.apple.com/quicktime/showcase

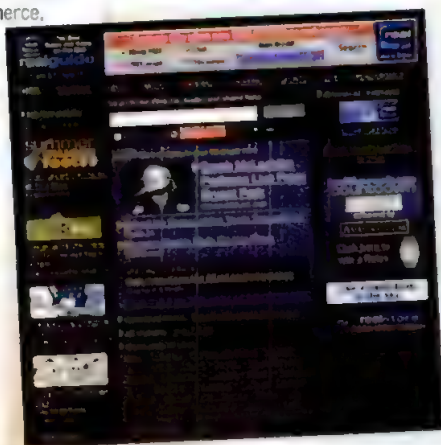
The QuickTime Showcase site provides a wide range of topics, such as current events in sports and news and even a history of dinosaurs from Dinotopia. But some of the samples are just that: Sites such as Bloomberg.com and NPR that don't offer any content in QuickTime format but have clips here.

RealGuide

realguide.real.com

When practically everyone doing

streaming audio or video on the Net is using your format, it's easy to put together an extensive list of links and content demos. This is what makes



RealGuide by far the strongest audio/video showcase site around. It offers music and news radio, entertainment clips, and a listing of current live broadcasts that you can view with RealPlayer G2. In addition, the RealJukebox showcase steers you to more music download sites than either a2b or Liquid Audio.

WindowsMedia.com

windowsmedia.microsoft.com

Though WindowsMedia.com doesn't have any multimedia content for you to view directly, it does offer a broad listing of sites that use the Windows Media Player, along with a preview of what clips you'll find at each site. The variety of topics is almost as great as what you'll find if you go to RealGuide, but the format lags in terms of the sheer number of sites using it when compared with Real.

MP3 Download Hubs

EMusic.com

www.emusic.com

One of the few legitimate MP3 download centers, EMusic.com features some artists you've actually heard of: Ray Charles, Iggy Pop, and They Might Be Giants, to name a few. It's also one of the few that charges you for MP3s. EMusic tries to make it worth your while by offering all of the songs on the albums it carries, something other sites rarely do. You can download a complete album for \$8.99, go song by song at \$.99 each, or browse through a listing of hundreds of free tracks.

MP3.com

www.mp3.com

With a deep selection of free songs from over 200 audio genres, MP3.com is the granddaddy of the digital music download sites. You'll find everything from O.J.N.K.'s "Disco Magic" in the disco section to Killer Sparr's "The Wookiee Who Shagged Me" in the comedy section. But beyond good content, this site is very well organized, with browsing by genre or artist and a search form that lets you search in specific areas of the site. Digital music newbies will appreciate the detailed MP3 help section.

Webcasting Hubs

Broadcast.com

www.broadcast.com

With a host of radio and television networks beaming out across the superhighway, Broadcast.com is the source of commercial broadcasting on the Net. Get live in-depth coverage of breaking news, see what people are wearing in Paris on

the Fashion Network, or sit back and watch the original version of *Night of the Living Dead*.

ChannelSeek

channelseek.com

Unlike Broadcast.com, ChannelSeek—more a *TV Guide* for the Web than a broadcaster in its own right—doesn't host most of the content you find on its site. ChannelSeek describes upcoming Webcasts of concerts, TV programs, news, and radio shows found on other sites and provides a link to the home page of the broadcasting site. Though it's a worthwhile stop for seeing what's playing on the cyber idiot box, ChannelSeek is still several games behind league-leading Broadcast.com.

Internet Radio

Imagine Radio

www.imagineradio.com

Ever wanted to be a deejay? Here's your chance, even if you don't have a deep



voice. Imagine Radio combines its own preprogrammed stations with stations that its members have created to give you a continually expanding and eclectic musical offering. You can customize your own station to include your favorite genres and artists, but the lack of player controls such as pause, stop, or skip means that you have to stop everything in order to change anything.

RadioMoi

www.radiomoi.com

Take the same features you find at Imagine Radio, add a deeper selection of



connections, delivering high-quality on-demand video will become realistic.

PC Magazine Labs has tested all of the competing formats in these different media—as well as the do-it-yourself tools they offer, and the most notable content sites—to help you determine which ones to use when you have a choice.

MP3 MADNESS

How we stand on the verge of a change in the way we listen to, receive, and record music is yet another tale of Web Davids forcing real-world Goliaths to mend their ways. A groundswell of

college students and forward thinkers grew tired of paying \$17 for a CD with one good song, tired of being fed only music that sells at least 500,000 albums. This group effectively created its own music distribution system, using a technology known as MP3, which lets people easily create a digital file of a song from a CD and then take advantage of the Internet as a means of sharing such files with like-minded folks.

Much of this is illegal, of course, and the major record companies, which control about 80 percent of the music produced in this country, could be the big losers. The record companies aren't going to give their stuff away using MP3, because MP3 currently

sights & sounds

preprogrammed music and talk stations as well as the ability to skip commercials and songs, and you have RadioMoi. Its best feature is its CD-style player controls, which include pause, stop, fast forward, and rewind. However, unlike Imagine and Spinner, which use RealAudio, RadioMoi uses the MP3 format, which makes its sound quality weaker at lower connection speeds.

Spinner.com

www.spinner.com

With hundreds of channels, including acid jazz, gospel, female blues, lounge, and even one dedicated to Mel Tormé, Spinner.com has the greatest variety of Internet radio programs. The standalone player—the strongest we've seen—lets you access all the genres directly. You don't have to open up a browser and go to the Spinner home page to launch any of its channels. The player includes a feature called SongPad that remembers your favorite songs in a personalized list for later playback. But, as with Imagine, there are no stop, pause, or skip controls available.



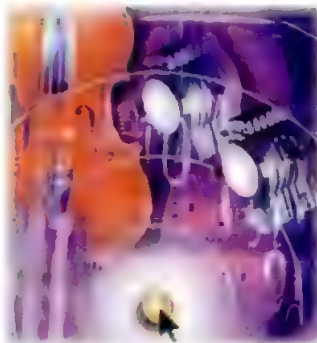
Audio Hubs

Audio Highway

www.audiohighway.com

A hodgepodge of music downloads, prerecorded radio programs, books on tape, and streaming news, sports, and weather, Audio Highway is an eclectic but entertaining collection of audio for streaming playback or download. Prerecorded radio programs vary from pop music to NPR's Marty Nemko trying to make your work life a little more

manageable. Listen to Orson Welles's "The War of the Worlds" or *The Wizard of Oz* on the Audiobooks channel, or move



to the MP3 download pages and save a bunch of music tracks from artists you've never heard of.

SonicNet

www.sonicnet.com

With news, streaming videos, and live events listings around the Internet, SonicNet is like Grand Central Station for listening to music online. Not only does

Radio SonicNet provide you with seven radio genres to stream while you surf, but Sonic's FlashRadio adds flashing images of the artists as the music plays. Tune into Streamland to watch the latest music videos from hundreds of artists, ranging from the Cranberries to Busta Rhymes.

Video Hubs

AtomFilms.com

www.atomfilms.com

Every week, sit back and watch one of four new top-quality short films online at AtomFilms.com. This site is the Internet presence of AtomFilms, which distributes and promotes shorts worldwide, from amateur student films to Academy Award nominees. Films range from the more conventional comedies and dramas to such unique treats as an animated spoof of "Larry King Live," starring two talking fish.

fasTV.com

www.fastv.com

Integrating streaming video seamlessly into virtually every story, fasTV.com brings you the next step in the digital evolution of what used to be your local daily paper. Video controls let you move forward and back between small clips of longer video segments taken from over 20 content partners, including CNN. Although its format is head and shoulders above your standard online source for general



news, fasTV is hampered by a relatively small amount of content in each of its sections (News, Sports, Business, and so on), especially in terms of daily updates.

Multimedia Search Sites

FileQuest

www.filequest.com

The strength of FileQuest's searches for downloadable audio, video, and image files lies in the simplicity of its structure. There is a single search page that has almost the same capabilities as Scour.net's advanced

search form, including targeted searches for RealMedia files, Vivo movies, and MP3 songs, among others. Returns are well organized and usually very accurate, and the Simba Downloader lets you save the files to a local directory with one click instead of going through the downloading structure of your browser.

Scour.net

www.scour.net

Scour.net has all the searching capabilities of FileQuest plus an array of multimedia-finding features and support for targeted searches on VDO movies, Liquid Audio tracks, and .au files. Returns are similar in quality to FileQuest's, though when you search for a video or an image file, the return comes with a thumbnail preview. The Downloadable Music page searches a handful of the major MP3 download sites, including Amp3.com, EMusic.com, and MP3.com, and the search returns tell you whether or not the download is free.

Do-It-Yourself Broadcasting

Live365.com

www.live365.com

It's almost too good to be true. Sign up at Live365.com and you get 100MB of server space to host your streaming audio—plus support for 100 MP3 streams—free. You can FTP your content to its site or do live streams (as the name implies). As a listener, you'll find more than 100 stations up and running, but most of them require a high-speed connection like a cable modem.

ShoutCast

www.shoutcast.com

Not only will ShoutCast get you broadcasting your own station, but you can peruse hundreds of independent radio stations using ShoutCast and hear the music. Although ShoutCast limits the number of streams you can support—only a few listeners at 56 Kbps, or 60 with a T1 connection—many of its users are commercial clients with high-speed connections.



LISTEN HERE

The Web is all about breaking down barriers, and nothing does that better than streaming audio. As this technology gains mass acceptance, you can now be anywhere you're not—at the Ohio State homecoming game or at a shareholders' meeting. The impact is profound. Everyone can enjoy content from anywhere in the world or create and share it (see the section "Streaming Audio").

500 CHANNELS? HAH!

The revolution will be Webcast—if you've got a fast Internet connection. The quality of streaming video is sadly lacking at

lacks any means to prevent redistribution, but the MP3 revolution helped demonstrate that the Internet could be an incredible distribution vehicle (see the section "Digital Music").

So the industry has worked to develop a secure mechanism for delivering music online. The Secure Digital Music Initiative (SDMI), which has the broad support of the record companies and technology companies such as Diamond Multimedia and RealNetworks, should be complete by early next year and will uniformly let the owners of the music determine what you can do with that song once you download it to your PC (see the sidebar "A Secure Future for Music").

modem speeds, but if you have a T1 line at work or a cable modem at home, you can get a glimpse of the future. Sample the 300-Kbps content available at sites like Broadcast.com or check out FasTV.com's news feeds. While clearly less than even VHS quality, the potential of immense video libraries, available totally on demand, does come into focus (see the section "Streaming Video").

The global reach and depth of selection that the Web offers will ultimately prevail over the way we get music, listen to radio, and watch television today. It's not about technology, it's about freedom of choice.

Editors' Choice



The audio and video delights of the Web await you. Here are our favorite formats for enjoying content, the sites where you can get it, and the tools to create your own magic.

Digital Music: None The winner is you. We put the competing formats—a2b, Liquid Audio, MP3, MS Audio, and RealAudio—to the test and came up with a dead heat. Using standard PC speakers that come with today's high-end PCs, we could not consistently and meaningfully distinguish between the formats.

Streaming audio and video: Real G2 Real was the pioneer in streaming Internet audio and is still the best. It delivers the best overall sound quality for speech and music, especially at the slowest modem speeds. And RealPlayer's combination of features and usability is unparalleled.

Although no one will mistake streaming video for television any time soon, it's nice to have streaming video available when you want to see content and not just hear it. Real offers an experience most resembling broadcast video in fluidity if not clarity.

Jukeboxes: MusicMatch JukeBox 4.0 You don't get flashing lights with these jukeboxes, but you'll still rock around the clock. All offer many excellent features, but MusicMatch has more playback and recording flexibility than any other product, giving it the edge. Its Auto DJ function lets you set playback duration and select songs by up to three general classes, such as artist, tempo, genre, mood, and situation.

Tools: RealProducer G2 After you've whet your appetite enjoying all the multimedia content that the Web has to offer, you might get the bug to put some up yourself. RealProducer G2 makes it easiest for beginners to create streaming audio and video. A number of useful wizards make the process painless, taking you from creating a file to transferring it to your ISP with no trouble at all.

MP3-to-CD software: JustAudio Want to make all those downloaded MP3s portable without investing in a dedicated MP3 device like the Diamond Rio? Remember CDs? With JustAudio, the most flexible MP3-to-CD solution in this roundup, all you need to do is drag and drop the files you want.

Web Sites

Best format showcase: RealGuide Being the first and best has its advantages. No other site has more content created in its format, and it's all here.

Best MP3 download hub: MP3.com Having the most MP3s (and the best system for finding them) makes MP3.com stand out from its competitors.

Best Webcasting hub: Broadcast.com Whether you're looking for that pennant race baseball game or your company's shareholder meeting, you'll find it at Broadcast.com.

Best Internet radio: Spinner.com Hundreds of channels to fit your every listening mood, personalized song lists, and a strong player make this product worth a spin.

Best video hub: fasTV.com Here's a compelling blend of video content integrated with stories tied to current events. Plain text will never be enough after fasTV.com.

Best multimedia search: Scour.net

If only your remote control could do this! Target your searches—and the returns for video files even come back with thumbnail previews.

Digital Music

The battle to determine which format will prevail in delivering near-CD-quality audio via the Internet is as heated as you might expect a fight over a \$20 billion pile of money to be. Five formats are fighting for this space—a2b Music, Liquid Audio, MP3, Microsoft's MS Audio, and RealNetworks. Each format's backers will tell you that its system provides the highest audio quality. But our PC Magazine Labs tests show that even to an audiophile, the differences are virtually imperceptible.

No, the real battle between the formats has everything to do with the music publisher's ability to protect its assets. The MP3 format, a public standard that makes creating and playing MP3 files easy—and which is serviced by a group of encoder and player developers—is easily distributed and therefore quite attractive to those not interested in honoring copyright laws. In response to the MP3 phenomenon, record companies have largely aligned themselves with secure formats like a2b and Liquid Audio, which allow them to give away, sell, or otherwise distribute audio while controlling redistribution.

On our jury tests, conducted with files encoded at the de facto standard of 128 Kbps from the major competing formats for producing near-CD-quality audio, our jury members could not express a consistent preference. We would play a song in one format, then play it again in a competing format and ask the jury to pick the one they preferred. Some members of the jury could not choose at all, hearing no discernible differences. Others would express a preference, only to switch when we replayed the tracks to help the undecided choose.

NOT YOUR CHOICE

For the most part, the Web site hosting the music will dictate your choice of format, so you may be locked into a particular one and not have a choice. Most Web sites choose just one, so audiophiles whose tastes are on the fringe are likely to continue using the MP3 format, while mainstream users will migrate toward a2b or Liquid Audio.

One alternative that gives you something of a choice is a software jukebox (see the section "Jukeboxes"). If you're using

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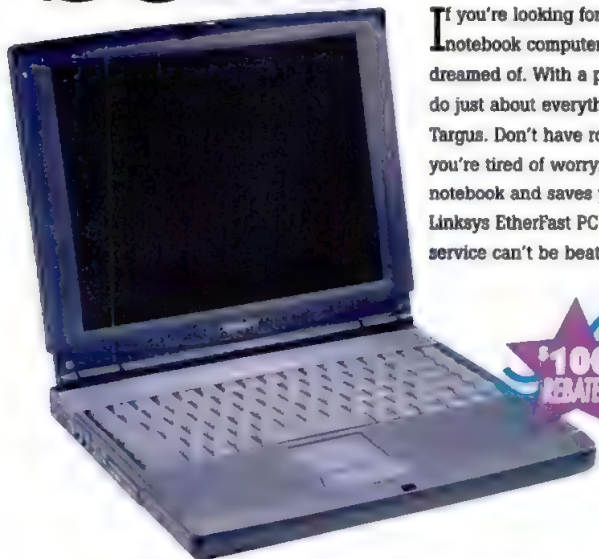
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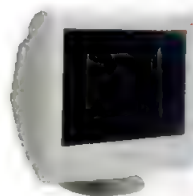
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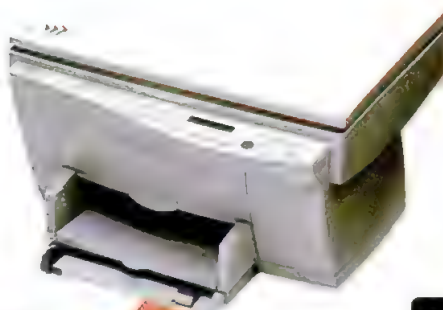
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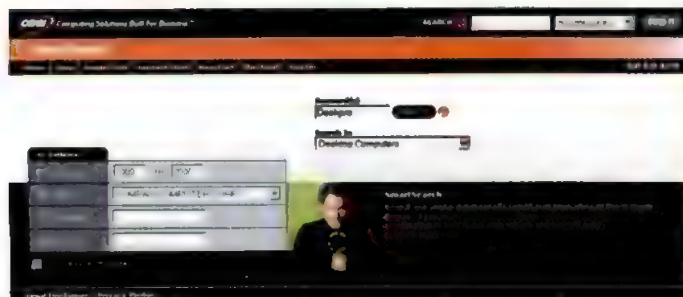
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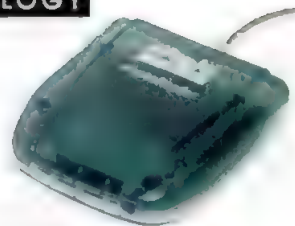
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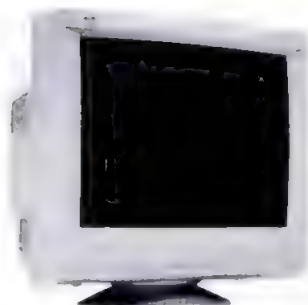
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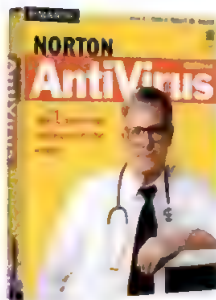
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RealJukebox, you can convert your audio CDs to RealAudio format; we've included Real in our evaluation because of this option. Real has also announced RealSystem MP, an architecture that will enable secure music delivery in the future, using RealJukebox as the client.

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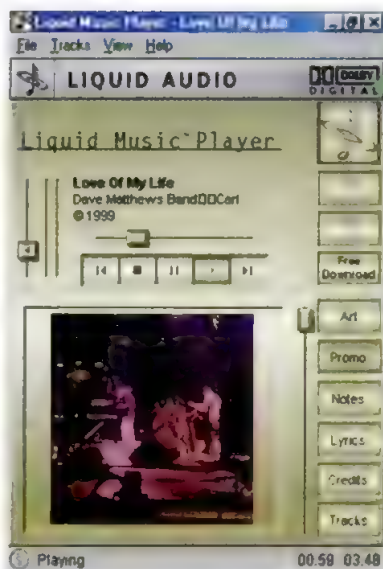
The simplest and currently the most popular means of downloading digital music is MP3. You simply select an MP3 track at a site and download it to disk (the vendor's e-commerce system handles any charges). Once the file is on a disk, you don't need a proprietary player, as you do with a2b or Liquid Audio. Many players—ranging from the Microsoft Windows Media Player to popular MP3 players such as WinAmp and Sonique—will let you listen to MP3 files.

Both a2b and Liquid Audio operate differently from MP3 because they have built-in systems to manage the digital rights specified in the copy of the song or album. With a2b, you install the player and then create a digital ID for encrypting the music and registering the software. When you click on an a2b-encoded song at a Web site, the server software at the music site encrypts the song to your digital ID, detailing your rights for subsequent uses of the music.

Once on disk, a2b's guitarlike player loads, revealing cover art, lyrics and credits, typical playback controls, and a rudimentary playlist. The most significant limitation is that a2b can't burn the files to a CD-R.

Liquid Audio's shopping experience is similar but has a better endgame. Once you install the player, you provide credit card information to acquire a "passport" that encrypts your files. When you click on a Liquid Audio song on a Web page, cover art, lyrics, and credits download to the player, along with room for notes and promotional graphics.

Purchased songs are loaded into a shopping cart from which you can download en masse after paying. However, since the Liquid Audio player actually manages the download, you can't shop at another site until the download is complete. By contrast, a2b can download multiple



The Liquid Music Player offers lots of extras along with the music.

songs from many sources at once.

Microsoft has announced that Version 4.0 of Windows Media Technologies will feature a Rights Manager that conforms to SDMI specifications. Combined with Microsoft's audio compression technology, MS Audio (which we evaluate here), will let Microsoft deliver a competitive solution to a2b and Liquid Audio. This system, however, was not in place and reviewable at press time.

On the whole, both a2b and Liquid Audio do an excellent job of not letting their management of digital rights hinder shopping or the legitimate playback experience.

Fortunately, these aren't the Betamax-versus-VHS days. Back then, allying yourself with the wrong format cost you hundreds of dollars. Today, choosing a format won't cost you any money or any shelf space. So sit back and enjoy the music.

Streaming Audio

Thousands of radio stations from around the world, innumerable special broadcasts not available elsewhere, music previews before you buy: These are a few of our favorite things about the Web. And none of them would be possible without streaming audio. The most entrenched of the media technologies we reviewed, it has the broadest range of content.

We reviewed six competing streaming technologies. Microsoft's MS Audio, RealNetworks' RealAudio, and Apple's QuickTime are the three primary streaming technologies and players. We also tested three technologies primarily used for music downloads—a2b, Liquid Audio, and MP3.

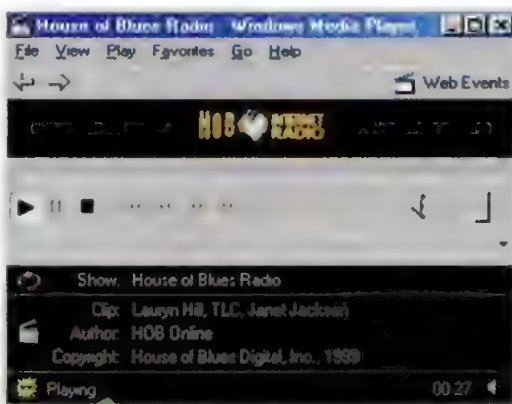
TALK RADIO

We evaluated speech quality at 28.8 Kbps (speech generally is encoded no higher than this lowest common denominator). For news, sports, or other talk-oriented streaming audio, RealAudio delivers the highest-quality experience. Our jury preferred it for both the male and female voice compar-

isons because it was truest to the original recordings.

MS Audio performed capably, with our jury finding the female speech clip close in quality to that of RealAudio. By contrast, QuickTime should not be anyone's choice for streaming speech at this low speed. The female speech clip sounded muffled and slightly metallic, and male speech echoed as if it had been recorded in a barrel.

Although you certainly won't encounter streaming MP3 at low bandwidth too often, it's not completely unheard of: We found it at RadioMoi (see the sidebar "Where to Get Your Web Sights and Sounds"). Surprisingly, our jury liked the quality of the MP3 speech: Some of the background noise that was in the original male speech test clip was filtered out, improving the sound quality.



Windows Media Player buries its best features under a dowdy interface.

Our Contributors: JAN OZER is a contributing editor of *PC Magazine*. EYAL RABINOVITCH is a freelance writer. JAY MUNRO was the senior project leader, and senior associate editor DAVID LIDSKY was in charge of this story.

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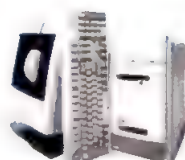
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The Jury Is In: Streaming Audio

	SPEECH (28 Kbps)		ROCK MUSIC		CLASSICAL MUSIC		ELECTRONIC MUSIC	
	Female	Male	28 Kbps	56 Kbps	28 Kbps	56 Kbps	28 Kbps	56 Kbps
 denotes Editors' Choice.								
a2b	Poor	Poor	Poor	Poor	Good	Good	Good	Good
Liquid Audio	Good	Good	Good	Good	Good	Good	Good	Good
MP3	Good	Good	Good	Good	Good	Good	Good	Good
MS Audio	Good	Good	Good	Good	Good	Good	Good	Good
QuickTime	Good	Good	Good	Good	Good	Good	Good	Good
 RealAudio	Good	Good	Good	Good	Good	Good	Good	Good

WEB TUNES

If you're more interested in tunes than talk, you'll find no shortage of content, and this is where you're most likely to find streaming Liquid Audio or MP3. We tested at both slower (28.8-Kbps) and faster (56-Kbps) modem speeds, because music is often offered at multiple data rates. Quality improves appreciably as you step up speed.

Again, RealAudio delivers the best overall quality at 28.8 Kbps. Our jury liked it across the board for our rock, classical, and electronic music test clips. Don't expect the music to be perfect, though; a slight phasing effect in the rock and classical tracks caused wavering in the tone, which marred the outcome compared with the original.

In our jury's opinion, QuickTime redeemed its disappointing showing on streaming speech by matching RealAudio's performance on the classical and electronic clips. On the rock clip, however, an echoing effect made Quick-

Time's recording less pleasing than RealAudio's.

MS Audio delivered a broad range and clear tone in the classical recording, making it top-notch with our jury for this clip, although still noticeably deficient when compared with the original. A slight pulsing effect in both the rock and electronic clips placed it behind RealAudio.

On our music tests, Liquid Audio performed comparatively well, with a top-tier performance close to that of MS Audio and RealAudio for classical music. But both a2b and MP3 performed poorly: MP3 came across flat and subdued, while a2b sounded muffled, with some ringing.

FASTER MODEMS, BETTER SOUND

At 56 Kbps, the competition grows more heated, with more of the formats able to deliver a sound that rivals the original for

listenability. RealAudio and QuickTime effectively tied. Each produced top-notch clips in the classical music category, with RealAudio acing the electronic clip and QuickTime winning our jury's favor on the rock sample. Though the Microsoft product continued its excellent performance in classical music, a slightly hollow sound and echoing in the rock and electronic songs made it less appealing than QuickTime and RealAudio.

Liquid Audio offered an excellent reproduction of the electronic clip, though a noticeable loss of dynamic range made the rock and classical tunes sound inferior

to what the pure streaming technologies could deliver.

THE PLAYERS

The media player you use for listening to streaming audio on the Web is likely to be created by the same people who created the audio format. There is some compatibility among players—for example, the Windows Media Player will play MP3 and QuickTime files as well as MS Audio files—but generally, you're stuck with the player for a particular format.

That said, if the quality of the music is equal among the formats and you have a choice, player features and usability will make a big difference in what you experience. We found RealPlayer (free) to be the most usable player in this group, with accessible

volume controls and simple, logical operation. The free version, however, lacks equalization controls; to get them, you have to upgrade to RealPlayer Plus (\$29.99).

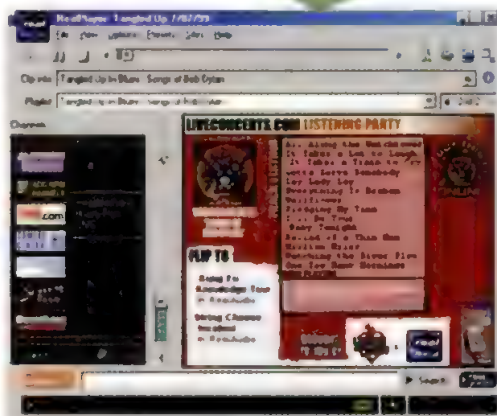
Though the most feature rich, Windows Media Player suffers from a lack of usability and a dowdy look. It buries great features like a graphic equalizer under three unintuitive layers of menus or cryptic menu descriptions like Windows Media Audio Decoder.

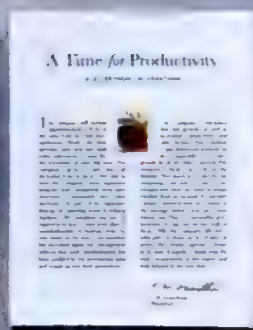
With QuickTime 4.0, Apple debuted a slick new player, though it contains only playback controls, with menu commands provided by a vestigial second player. Upgrade to QuickTime Pro (\$29.95) and you get bass, treble, and balance controls conveniently located in a tray that slides out of sight when not in use.

RealNetworks pioneered streaming media and never looked back, delivering an unbeatable combination of format quality and player usability for broadcast. And while it's not the absolute best, Liquid Audio does produce a high-quality signal in low-bandwidth modes.

Streaming Video

Whereas streaming audio offers amazing quality at slow modem speeds, watch any streaming video and you'll be amazed that anyone watches at all. The allure of streaming video today isn't quality but accessibility—the ability to watch breaking news while you're at work or a video of your new god-daughter from afar. Still, though we compare audio technologies against CD quality, we compare streaming video technologies





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The Jury Is In: Streaming Video



only against one another, because it's no contest otherwise.

Many Web sites now offer the same videos encoded with two or more technologies, primarily chosen among three candidates that dominate the market: Apple's QuickTime, Microsoft's Windows Media Technologies and RealNetworks' RealVideo. After comparing video quality and player usability, we'd choose RealVideo, though at 56 Kbps, the Microsoft player's video quality was tops.

UNSAFE AT ANY SPEED

Our test clip was a composite video showing talking heads, operating machinery, a violinist in action, and several other scenes of varying motion.

RealVideo easily won the slow-modem speed test (28.8 Kbps, 176-by-132 resolution, or postage-stamp-size), primarily because

the clip achieved the best trade-off between frame rate and frame quality. Though many individual frames were slightly more degraded than those of the runner-up, Microsoft's Windows Media Technologies, RealVideo displayed more frames per second, achieving greater fluidity.

By contrast, the frame rate of the Microsoft video slowed to one every 2 seconds in high-motion scenes, while that of the QuickTime video dropped to one every 5 or 6 seconds during our most dynamic scenes. The latter also lost contrast during the talking-head segment, converting our speaker into a big white blob.

Windows Media won the fast-modem comparisons (tested at 56 Kbps), because it didn't exhibit the problems its competitors did. RealVideo looked strangely out of sync, uncharacteristically running at fewer frames per second than the Microsoft clip and showing frequent blocks, smears, and other artifacts.

RealVideo reclaimed the winner's circle on the high-speed clip (200 Kbps, 320-by-240), once again showing a great blend of frame rate and quality. Microsoft's playback often slowed significantly, which marred its viewability. QuickTime started well in the talking-head video but again exhibited blockiness in many scenes.

PLAYERS

RealVideo won the battle of the players with its functional, intuitive controls and attractive appearance. By contrast, Microsoft's Windows Media Player lagged far behind both RealVideo and QuickTime, burying features that should be right on the player deep in the menus.

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QuickTime has two windows: a futuristic player window and a menu bar. Unfortunately, the new player window contains only playback controls; activities like zooming and saving favorites are handled in the menu bar. The lack of right-mouse-click support exacerbates this clumsiness.

Jukeboxes

Thumb through the Sharper Image catalog and you might find a jukebox for sale—one that sets you back four figures and takes up half your rec room. But if you want to save some money and space, you could download one of the software jukeboxes from MusicMatch (www.musicmatch.com), OneStep (www.onestep.com), or RealNetworks (www.real.com), all of which offer highly functional and engaging MP3 jukeboxes.

Software jukeboxes let you record your audio CDs, store the songs on your hard disk along with tracks downloaded from the Internet, and queue single or multiple songs for playback. This broad functionality has essentially eclipsed the limited functions of MP3 players like Nullsoft's

WinAmp or Microsoft's Windows Media Player. All jukeboxes owe much to WinAmp (free download; \$10 to register), still the best pure MP3 player and the first to offer now-standard features such as playlists, preamps, graphic equalizer controls, and others. If you can live without CD-to-MP3 encoding features, WinAmp is a great choice.

On the whole, MusicMatch provides the most flexible playback experience, though only OneStep offers high-bandwidth MP3 recording in its free version. The jukebox you choose will depend upon the value you place on recording convenience, audio quality, playback flexibility, and player appearance.

OneStep's Jukebox Xtreme is the only free jukebox that can record CDs or other digital music in the MP3 format at up to 256 Kbps, delivering virtually CD quality. By contrast, the free versions of both MusicMatch's Jukebox 4 and Real's RealJukebox max out at 96 Kbps, which exhibits occasional warbles and other audio artifacts. You can pay \$29.99 to upgrade the MusicMatch Juke-



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Now that you're ready to use your computer to get music and store your current CD collection, you don't need to turn your CD player into a doorstop and your CDs into coasters. You can marry downloading MP3 music onto your PC with the ubiquity of stereo CD players without too much fuss.

Today you can buy PCs with compact disk-recordable (CD-R) drives or add a CD-R drive to your existing computer so that you can create your own CDs. Though those drives most likely have bundled software that lets you create CDs, they are not necessarily ready to handle MP3 files. So you need software that lets you convert MP3 files into WAV files, which the CD drive can handle.

We tested four MP3-to-CD programs with four drives—the ACS Innovations CDRW 4420, the Philips CDRW400, the Ricoh MP7040S, and the Yamaha CDR100, with very mixed compatibility results.

Our favorite is CeQuadrat's *justaudio* (\$49, www.cequadrat.com), a former *PC Magazine* Editors' Choice winner that can now accept MP3 input. *justaudio* has basic encoding controls for novices and additional controls for advanced users. You select file location with an Explorer-like directory and then drag files into the CD-R layout screen, where you can trim, equalize volume, or remove pops and clicks. *justaudio* was compatible with two of our four test drives, but CeQuadrat provides an extensive and frequently updated driver list on its Web site.

In contrast with *justaudio*'s cushy ride, Creative Digital Research's *HyCD Play&Record 2.1* (\$59.95, www.hy cd.com) favors a

minimalist approach. After selecting the desired MP3 tracks through Windows Explorer or My Computer, you select HyCD copy from the right-click menu, then paste the files onto the target CD-R drive. This procedure spawns a playlist applet with controls for changing song order, adding additional songs, and removing pops and clicks. However, you can't save the CD-R project, though you can burn a partial CD and add more songs later. Compatibility is a strong point; HyCD writes to all drives save the brand-new ACS CDRW 4420.

Whereas HyCD and *justaudio* are traditional CD-R programs that have added MP3 capability, AudioSoft's *Virtuosa Gold* (\$27.99, www.audiosoft.com) and PTS Software's *AudioCD MP3 Studio* (\$27.75, products.pts-shop.de/) were developed specifically for MP3 recording. Their feature sets and compatibility compare poorly with those of the established programs.

For example, *Virtuosa Gold* was incompatible with all four test drives. *Virtuosa* is primarily an MP3 jukebox, and you select files to burn by dragging them from the music database into the playlist and then pressing the record button. *Virtuosa* is the only product that doesn't monitor CD-R capacity, forcing you to track the size of your selected files manually.

Our other MP3 entry, *AudioCD MP3 Studio*, offers bare-bones functionality. The program consists of a single window in which you can rip tracks from a CD or burn MP3 and WAV files to a CD-R. After loading and arranging your tracks, you simply select write speed, decide whether to normalize audio volume, and then burn the CD.

MP3 Studio's no-frills interface lacks such basics as the ability to remember where you last retrieved your MP3 files. The bright spot is that the software supports more than 295 CD-R drives, though it proved compatible with one of our test units (the Yamaha CDR100).

If you can't use your current CD-R software to burn audio CDs, your best choice is to go with *justaudio*. —JO



box and record at up to 160 Kbps in MP3 format. Real will soon offer a Plus version with a higher recording output (expected to cost \$29.95).

Of course, you'll want to balance how much hard disk space you allot to your music against your acceptable level of quality. A 4-minute song recorded at 128 Kbps eats up almost 4MB, so if your music sounds good enough at 96 Kbps or 64 Kbps, take advantage of being able to get much more onto your hard disk.

Though *OneStep* delivers better quality, it's the only jukebox that can't simultaneously record audio from a CD while playing it. *RealJukebox* can encode songs at faster than real-time speeds, and it is also the only product that lets you elect to secure your recordings to prevent them from being played on another computer. Only *MusicMatch* accepts analog input, letting you record cassettes or vinyl that you'd like to convert to MP3.

Start recording a CD and all three products will download album and track names from the Internet. But only *MusicMatch*

supports the full ID3v2 standard, letting you view liner notes, album covers, lyrics, and bios.

As your collection grows, *MusicMatch* offers the greatest playback flexibility via its Auto DJ function, which lets you set a playback duration and select songs by up to three general classes, such as artist, tempo, genre, mood, or situation. All three products let you easily create fixed playlists from your stored files.

After you've created your playlist, all three programs offer compact players that sit unobtrusively on your desktop. Real's is the most competent, though it lacks the graphics equalizer offered solely by *MusicMatch* (Real plans to put one into the Plus version). *MusicMatch*'s player doesn't have volume control, and it posts the least on-screen information about the artist and song. *OneStep*'s player, however, is excellent. It's slightly larger than the others, with volume and scan controls and scrolling information about the artist and song title.



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A secure future for music: Protecting artists' rights

M P3 is undoubtedly a grassroots phenomenon that any politician must envy for its swift and impressive rise to prominence. But despite the stunning amount of content you can get from the Web in the MP3 format, it is a small fraction of the music produced and distributed in this country. The lion's share of your listening pleasure is not available on the Internet and won't be until the five major record companies that control it feel secure in having a means to distribute music digitally without fear of illegal transfers.

To that end, these companies—BMG Entertainment, EMI Recorded Music, Sony Music Entertainment, Universal Music Group, and Warner Music Group—have let themselves be dragged kicking and screaming into the future by forming the Secure Digital Music Initiative (SDMI). Their goal is to discover a means of leveraging the Internet's limitless distribution potential while still collecting royalties to pay to copyright holders.

By settling on a secure distribution method for delivering music over the Internet, the SDMI will let the distributor of the work set the terms of use for the music you purchase. This is known as digital rights management.

The SDMI consortium consists of more than just record companies: It includes 117 technology companies, among them Liquid Audio, Microsoft Corp., and RealNetworks. This broad-based sup-

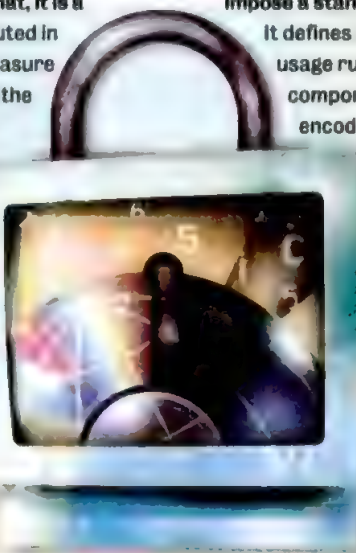
port should ensure that the ultimate outcome will be compatible across the competing formats.

SDMI is not trying to rule between the competing formats and impose a standard. It's more an architecture than a technology. It defines how hardware and software devices respect the usage rules embedded in music by its creators and how all components work together, but it doesn't define which encoding formats to use or examine other technology issues in music distribution.

Since the SDMI standard is not yet complete, none of the rights management technologies currently in use, including InterTrust Technology's PowerChord and Microsoft's Media Rights Manager, are SDMI compliant. The companies concerned are expected to evolve towards interoperable SDMI-compatible products within months after the release of the final specification. SDMI released the portable device specification in July to give manufacturers time to be SDMI-compliant by the holiday shopping season. The entire SDMI initiative is expected to be completed in the

first half of 2000.

If it isn't, and the market continues with a number of incompatible technologies, consumers might ignore all initiatives and default back to the unregulated MP3 format, ultimately stifling the growth of the Internet as a distribution channel for music. —JO



In general, MusicMatch's broader recording and playback functionality gives it an edge over the other two. If audio quality is paramount, though, and you're not willing to shell out \$29.99 to get there, OneStep may be your best choice.

Encoding Tools



Whether you have a garage band and want to share your tunes with the world or want to let Grandma in Dubuque easily view your daughter's first steps, you'll find a host of entry-level tools that let you take your multimedia content and put it on the Web.

The first decision you have to make is whether you want to have your content available for download or stream it. If you're creating MP3 downloads, you can use any of the MP3 jukeboxes (reviewed in the section "Jukeboxes") to take your WAV audio files and create MP3s.

The basic tools for creating streaming content for the Web are known as *encoders*. Those in Real's or Microsoft's Windows Media Technologies formats are free and fairly easy to use. Real's tools are the most polished and comprehensive, with a good lead over those of runner-up Microsoft. QuickTime Pro, though highly functional, costs \$29.99 and offers the fewest creature comforts of the group, making it a tough sell for novice

streaming-media publishers.

Real's primary free audio/video encoding tool is RealProducer, which uses wizards to glean information about your source materials and target viewers to formulate the optimal parameters for creating the file that you post online. After encoding, another wizard walks you through various Web design options and lets you preview a page. If you like the way it looks, yet another wizard helps transfer the necessary files to your Web site, with templates for popular ISPs like AOL and MindSpring.

Microsoft has its own basic audio/video encoding tool—Windows Media Encoder (WME)—and also bundles codeveloped tools like Sonic Foundry's On-Demand Producer (ODP) for audio and video and Digital Renaissance's Windows Media Author (WMA) for still images, audio, and hyperlinks. The only advantage of using WME occurs if you want to stream live events, but otherwise, ODP offers the same templates—plus batch compression and HTML creation, which WME lacks.

Apple offers no free encoding tool—just QuickTime Pro, which lets you export video files to a range of formats but lacks templates, wizards, or any other niceties for novices. In fairness to QuickTime Pro, it is much more capable than the Real or Microsoft tools and has the ability to create special effects, multiple-language tracks, animations, and transitions. 

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CACHE SERVERS

The Low-Cost

A WEB PAGE IS REQUESTED from a browser configured for a cache appliance.

Request

Cache appliance

THE INITIAL PAGE REQUEST IS SENT from the cache appliance through the firewall to the Web server on the Internet.

Router/
firewall

THE PAGE IS THEN STORED in the cache appliance and also delivered to the client's desktop.

SUBSEQUENT REQUESTS are returned directly from the cache appliance.

Road to the Internet

By Jeffrey G. Witt



How
Cache Servers
Save You
Time



THE INTERNET IS A RISING TIDE OF INFORMATION, PROVIDING us with communications and content critical for conducting day-to-day business. But businesses want something the Internet wasn't created to deliver—speed. According to Peter Christy, an Internet traffic analyst at market research firm Collaborative Research, the average Internet request makes 19 hops before landing at its final destination. Multiply that by the number of users on the Internet and you start to get the picture. And the situation will likely get worse before it gets better, as the availability of business-related information on the Internet increases and more users get online. International Data Corp. recently speculated that the number of corporate users accessing the Web will at least triple over the next two years.

Until now, conventional wisdom was that the answer to poor performance in accessing the Internet is more and fatter pipes from a company's network to the Web. But the cost of more bandwidth can quickly add up when you're outfitting your entire organization—and it won't even solve the problem, because page requests make

AS THE WEB SITE UPDATES its information, the page stored in the cache appliance is continually refreshed and kept current.

IN THIS REVIEW

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so many hops outside of your network. The solution: caching products. These products bring the pages closer to the end user, where they can be accessed more quickly. There are a range of caching solutions, including proxy servers, cache appliances, enterprise cache servers, and caching service providers (see the sidebars "Which Caching Solution is Right for You?" and "Expandable Cache Services").

For a small to medium-size business, a caching appliance is a promising alternative to slow Internet access. A caching device follows the network appliance trend; it's extremely easy to set up and configure and offers robust management tools. It's also scalable and has a built-in OS that needs no administration. Essentially, these products serve as intermediaries between requesting clients and servers on the Internet or intranet. The pages are stored on the caching device and can be delivered to the end user as quickly as the network will allow. This means never having to leave your network, thus eliminating the vagaries of the Internet. Since most users access the same sites again and again, you should see benefits almost immediately. And although some data—such as streaming media—isn't cacheable (referred to as *cache misses*), and the off-loading of your traffic can vary, most companies will typically benefit by a 35 percent hit ratio (meaning that for all client requests, 35 percent will be satisfied from the cache), according to Collaborative Research. So it's easy to improve the health of your network and enjoy potential savings on the purchase of additional bandwidth. Besides preserving your network architecture and reducing cost, you'll be delivering quick Web pages to your users.

Caching isn't a new concept. Caching products have been deployed at large Web sites and ISPs for several years now. And caching is used on the desktop as well. Frequently used data is stored in memory for hardware components such as CPUs and for software such as browsers and operating systems. But as

Editors' Choice

• CacheFlow 500



The most well-rounded offering in our cache appliance

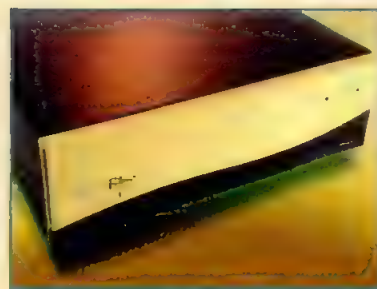
group—and hands-down Editors' Choice—is the CacheFlow 500. Though it is among the priciest

of the bunch at \$9,995 list, the unit delivers great performance numbers, excellent management tools, and a no-hassle installation routine.

The CacheFlow is the only product in our roundup that uses a proprietary operating system (the others are Netware- or Squid-based), which was designed from the ground up with caching in mind. Also unique to the CacheFlow are two performance-enhancing features: *DNS caching* and *object pipelining*. Both work to streamline the caching process and deliver pages to the end user faster.

the Internet becomes more integrated into everyday business, the need for these solutions inside corporate networks is becoming clear. In addition to speeding up Web access, these devices can be used to distribute needed data, such as sales reports and information from external and internal Web servers, to users at headquarters and branch offices. Cache appliances store the most frequently information in their memory and disk subsystems, so even users exploring different territories at the same site can benefit. But the best part is that they are affordable—the ones we reviewed cost between \$3,000 and \$10,000—and easy to install and manage.

Each is a sealed system managed through a Web browser, requiring little IT expertise and minimal user intervention. Each product fits into your network by running transparently; you need only



You manage your CacheFlow unit through the Java-based CacheFlow Network Management Console, which is completely browser-based. The detailed, tabbed menus give you quick access to loads of statistical and administrative data. Server settings and security are similarly managed.

Also of note is the Novell-based Dell PowerEdge ICS1300B. It comes standard with two hard disks, a feature that contributes to its impressive performance. And even with the added hard-disk muscle, the unit is competitively priced at \$5,299 list.

direct the traffic through a router or similar device. All of the devices we reviewed can also run in proxy mode, (but like the software products, they require browser configuration), or in what's called *reverse proxy*, which essentially means placing the box in front of your public Web server for outside access. For scalability and fault-tolerance, each box can be run in a cluster connected by the standard Internet Caching Protocol (ICP) or, in the CacheFlow 500's case, both ICP and the Cache Array Routing Protocol (CARP). But you can also use a third party load-balancing device or Layer 4 switch for better performance, since these can forward traffic more quickly.

Of course, there are alternatives to these appliances. Software proxy servers by Netscape and Microsoft running on a Windows NT server use caching to store Web pages and improve network performance. While these products are less expensive than cache appliances and continue to garner success, they require hardware and software integration, are

Our Contributors: JEFFREY G. WITT is technical director for networking and communications, and ANDREW GARCIA is a technical analyst at *PC Magazine*. SARAH L. ROBERTS-WITT is a freelance writer. RUSS IWANCHUK was the project leader, and JENNIFER TRIVERIO was the associate editor in charge of this story.



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less reliable when run along with other programs, lack of fault tolerance, and need to be configured at each user's desktop. There are also off-the-shelf components that allow savvy network managers to build their own open-source appliances, but along with these come support and maintenance trade-offs.

For this story, we looked solely at cache appliances, and tested units from CacheFlow, Cobalt Networks, Compaq Computer Corp., Dell Computer Corp., Eolian, and Industrial Code and Logic (ICL). All are aimed at small companies and branch offices, typically with T1 Internet connections. Entera Corp., which makes the TeraNode Server, declined to participate. Each of the servers we reviewed performs one task—caching Web-based content. Our testing focused on both the enhanced Web-browsing performance each unit brings to a network, and each device's management and administration capabilities. Our Editors' Choice, the CacheFlow, provides excellent performance and is the hands-down winner in terms of management. For the most part, we found all the systems passed the plug-and-go appliance test for setup, and we saw comparably good management tools from Compaq and top-flight performance from Dell.

Most of these vendors offer higher-end models for larger corporations as well. The upscale offerings have more RAM, hard disks, CPUs, and improved network interfaces. In addition, companies that have thus far offered only high-end and high-priced products (see the sidebar "High-End Carrier-Class Caching") will



For the **setup** rating, we take into account the installation, setup, and configuration processes for each cache appliance. We consider the complete installation time, documentation, and ease of implementation as relevant criteria. The **management** rating reflects the ease and power with which administrators can manage and maintain

the appliance. We look to see if the interface is intuitive and if reporting is in text-only form or graphical. GUIs that perform configuration actions are preferable to those that perform only simple statistics reporting. We look for products that offer reporting capabilities, performance statistics, and logging capabilities. **Performance** ratings are based on scores the units received on our performance tests. Relevant factors include requests per second and object latency.

EDITORS' CHOICE	CacheFlow 500	Setup	Management	Performance
	Cobalt CacheRaQ 2	Good	Excellent	Excellent
	Compaq TaskSmart C-1200R/ICS	Excellent	Good	Fair
	Dell PowerEdge ICS1300B	Good	Good	Good
	Eolian InfoStorm R1	Good	Good	Excellent
	Industrial Code and Logic WebSpeed Model 16000	Fair	Fair	Good
		Good	Fair	Good

soon join the fray on the small-office end. Product announcements are expected from caching vendors such as Cisco Systems, InfoLibria, and Network Appliance. Inktomi and Network Appliance already dominate much of the Internet side of the equation, but the business side is wide open.

All the products in our review rely on Intel-based commodity hardware, but for software architecture, we saw three different schemes. The systems from Cobalt, Eolian, and ICL are built on open-source software (Linux and the Squid caching engine). The Compaq and Dell units incorporate Novell's Internet Caching Service (ICS); CacheFlow deploys its own CacheOS. Each one of these schemes offers methods for assuring that the cached data is kept current. Old data,

even if quickly delivered, is useless. Novell's ICS offers the capability to schedule data updates of popular Web sites ahead of requests, and CacheFlow implements an algorithm to calculate what data needs to be refreshed based on usage patterns of requests. Eolian's data-refreshing capability is conceptually similar to that of CacheFlow; Eolian uses the EagleWatch service, which requires clients to subscribe to its Internet-wide community of caching servers.

Cache appliance vendors tout their products as speedy, single-purpose hardware and software solutions that provide transparent operation, fail-over schemes, and easy manageability.

CacheFlow 500

Tested configuration, \$9,995 list. Palo Alto, CA; 888-462-3569; www.cacheflow.com.

mation on Squid software.

► The Cache Now! Campaign vancouverwebpages.com/CacheNow

This site definitely achieves its goal: to increase awareness and use of proxy caching on the Internet.

► Web Polygraph: proxy performance benchmark www.ircache.net/Polygraph

Web Polygraph is a performance-testing tool for Web cache proxies that includes Web client and server simulators.

► Internet Caching Resource Center www.caching.com

This indispensable site offers plenty of news, product information, and research on Internet caching.

► NLNR Squid Site squid.nlnr.net

This is the source for infor-



The most complete, innovative caching solution in this roundup, the CacheFlow 500 offers a proprietary operating system, cache engine, and performance-enhancement features. Despite the high price, its excellent setup routine, superior management tools, and high-end performance make this system our Editors' Choice.

Unique to CacheFlow products is the company's operating system, called CacheOS, designed specifically to perform caching tasks. Among the CacheFlow's



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► Internet Caching Resource Center www.caching.com

This indispensable site offers plenty of news, product information, and research on Internet caching.

► NLNR Squid Site squid.nlnr.net

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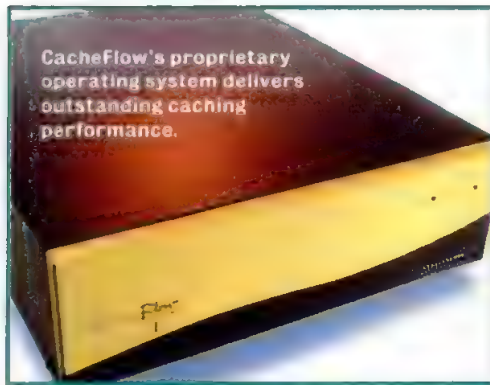


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for handling multiple T1 Internet connections.

Setting up the system is straightforward. Just attach the provided serial cable and run a terminal program such as HyperTerminal; then assign the appropriate IP addressing information. Once the settings are configured, you can completely manage and monitor the server through a browser using the slick Java-based CacheFlow Network Management Console. For users who are more comfortable with

most noteworthy features are two performance enhancements: *DNS caching* and *object pipelining*, techniques that allow page objects to be delivered in a parallel stream rather than by the multiple round trips required by browser technology. For additional reliability, multiple instances of CacheOS are present on each disk; one of these will start in case of software or hardware failure.

The appliance comes in a sealed, rack-mountable box and includes a 500-MHz Pentium III processor, 384MB of RAM, a 10/100 Ethernet card, and two 9GB hard disks. Unlike the other products, the CacheFlow 500 can accommodate two additional Ethernet adapters

a command line interface, CacheFlow provides a familiar routerlike configuration scheme to achieve the same results. A noteworthy addition is a set of tools that gives you the ability to deny access to specific sites, as well as to define sites that you may not want to cache.

The software far exceeds the competition in terms of ease of use, detail, and graphical representation. Simply laid out screens and tabbed menus let you navigate statistics and administrative data in detail. Similarly, the appliance's settings can be easily changed, and the hardware can be easily monitored. You're able to see environmental variables such as temperature, voltage, fan, and disk activity.

Simple pie charts show the efficiency and contents of your cache, and you can set the data freshness by percentage. The unit's easy-to-set security system includes e-mail alerts for remote notification as well as an SNMP agent to work with larger management scenarios.

Even though our performance tests don't account for the potential performance benefits of object pipelining, the CacheFlow 500 acquitted itself quite well in our labs. The server appliance turned-out impressive performance results in both throughput and latency—similar to the Dell PowerEdge ICS1300B, and benefited, as the Dell unit did, from the addition of a second hard disk.—JGW

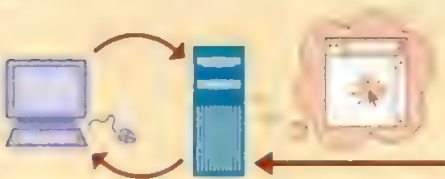
Cobalt CacheRaQ 2

Tested configuration, \$3,299 list. Mountain View, CA; 888-702-6225; www.cobalt.net.com.

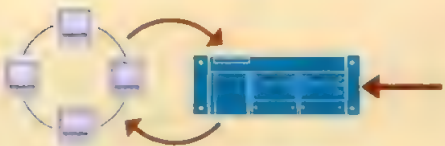
● A new addition to Cobalt's roster of affordable, Linux-based appliances, the Cobalt CacheRaQ 2 is the least expensive and smallest product in our roundup. Where most of the other product lines scale up toward faster WAN connections and more users, Cobalt has taken aim at T1 and E1 WAN speeds or slower. Though it posted the lowest

Which Caching Solution Is Right for You?

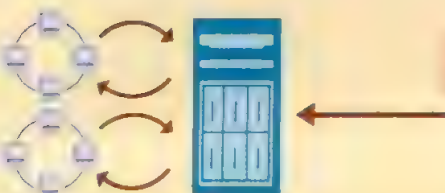
For most businesses, speedy, inexpensive access to the Internet is a necessity. There are several means to this end.



SMALL BUSINESS A software-based solution is an affordable way to introduce caching to your network. Microsoft Proxy Server, Netscape Proxy Server, and Novell's BorderManager add many of the features that are found in cache appliances. They require hardware and software integration that can be tricky, however, and they can become less reliable when running with other programs. Also, they need to be configured at each user's workstation.



MEDIUM-SIZED BUSINESS Cache appliances are a great fit for small to medium-size businesses. They move content closer to you for faster access and a better Web experience, and they may save you money to boot. These products serve as intermediaries between requesting clients and servers on the Internet or an intranet. The pages are stored on the caching device and then are available for the next request more quickly.



ENTERPRISE Larger businesses can consider high-end, enterprise-level caching products. These devices include many additional processors and significantly more disk storage space than cache appliances do. Traditionally, enterprise-level cache servers were employed by ISPs at their network operations centers. As corporations become ever more wired, however, the need for this type of cache product has migrated from the ISPs to the corporate level. Thanks to the proliferation of Internet access, intranets, and extranets that connect branch offices and business partners, traditional companies have begun to invest in heavyweight caching appliances.

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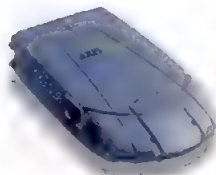


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SUMMARY OF FEATURES

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Cache Appliances

PC MAGAZINE
EDITORS' CHOICE

	CacheFlow 500	Cobalt CacheRaQ 2	Compaq TaskSmart C-1200R/ICS	Dell PowerEdge ICS1300B	Eolian InfoStorm R1	Industrial Code and Logic WebSpeed Model 16000
■ YES □ NO						
List price of tested configuration	\$9,995	\$3,299	\$10,340	\$5,295	\$1,995	\$4,400
WEB CACHE FEATURES						
Traffic types cachable	DNS, FTP, HTTP	FTP, HTTP, Gopher, Java applets, Java-Script	DNS, FTP, Gopher, HTTP, NNTP	DNS, FTP, Gopher, HTTP, NNTP	DNS, FTP, HTTP, WWW, other streaming	DNS, FTP, HTTP
Cache protocols supported	ICP, WCCP	ICP	ICP, WCCP	ICP, WCCP	ICP, WCCP	Cache Digest, CARP, ICP
Maximum concurrent connections	Info not available	500	100,000	100,000	1,536	4,000
Deployment modes supported	Forward, reverse, transparent	Forward, reverse, transparent	Forward, reverse, transparent	Forward, reverse, transparent	Forward, reverse, transparent	Forward, reverse, transparent
Mode of transparent support	Level 4 switch or router with WCCP	Level 4 switch for fail-over and scalability	Level 4 switch, multiple NICs, WCCP	Level 4 switch, multiple NICs, WCCP	Proprietary redirector unit	Level 4 switch, multiple NICs
Security	URL blocking, firewall, user authentication, IP blocking	URL blocking, IP blocking	URL blocking, firewall, user authentication	URL blocking, SOCKS4, SOCKS5	encryption, user authentication	firewall, IP blocking
IP blocking via client/source	■ ■	■ ■	■ ■	□ □	■ ■	■ ■
Prespecified downloading	■	■	■	■	■	■
MANAGEMENT						
Configured via browser/command line/proprietary interface	■ ■ □	■ □ □	■ ■ □	■ ■ □	■ ■ □	■ ■ □
Monitor's cache performance/hardware	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
Definable content refresh	■	■	■	■	■	■
Definable maximum size for cache object	■	■	■	■	■	■
Generates reports	■	■	■	■	■	■
Remote management	GUI, telnet, SSH	GUI, telnet, SSH	GUI	GUI, telnet	GUI, telnet	GUI, telnet
SNMP agent	■	■	■	■	■	■
Management alerts	■	■	■	■	■	■
Standard warranty (hardware only)	1 year	1 year	3 years	2 years (1 year on-site)	2 years	1 year
HARDWARE						
CPU	Pentium III/500	QED, 250	Pentium II/450	Pentium III/450	Celeron/433	Pentium II/400
System memory (installed/maximum)	256MB / 384MB	256MB / 256MB	256MB / 256MB	256MB / 256MB	512MB / 1GB	256MB / 256MB
Cache storage capacity (installed/maximum)	18GB / 18GB	10.5GB / 10.5GB	9.1GB / 9.1GB	18GB / 18GB	13.4GB / 14GB	16MB / 24MB
Number of disks (installed/maximum)	2 / 2	1 / 1	1 / 1	2 / 2	1 / 1	2 / 6
Ethernet interfaces (type/installed/maximum)	10/100 Mbps / 1 / 3	10/100 Mbps / 2 / 2	10/100 Mbps / 2 / 2	10/100 Mbps / 2 / 2	10/100 Mbps / 1 / 1	10/100 Mbps / 2 / 2
19-inch rack-mountable	■	■	■	□	■	■
SOFTWARE						
Operating system	CacheOS	RedHat Linux 2.0.34	Modified NetWare 5	Modified NetWare 5	RedHat Linux 2.2.10	RedHat 5.x
Caching software used	CacheOS	Squid	Novell ICS	Novell ICS	Squid	Squid
Web-based GUIs/OS command line	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■

scores on our tests, it provides value for small budgets, for installations with lighter traffic, or for anyone who wants to run multiple units in parallel.

Cobalt uses the Squid caching engine from the National Laboratory for Applied Network Research (NLNR)—specifically Squid 2.1, Patch 2—running on top of the Linux 2.0.34 kernel. We tested a top-of-the-line CacheRaQ in our labs; it had a 250-MHz MIPS processor, 256MB of memory, and a 12.7GB hard disk. All CacheRaQs have dual 10/100-Mbps Ethernet ports. Likewise, all CacheRaQs can proxy and cache FTP, Gopher, HTTP, and Java traffic.

The CacheRaQ 2 includes an elegant and functional LCD-and-keypad inter-

face that speeds initial setup, letting you set the IP address and gateway in only a minute or two. Once the box is set up, the LCD shows the box's host name and IP address, which can be useful in a densely packed environment. You can also reboot the unit using this display.

This appliance can be set up as a traditional proxy, but it also has support for transparent operation by using a Level 4 switch or load balancer and configuring the appliance to route between its two Ethernet interfaces. The CacheRaQ can participate in a cache hierarchy using the Inter-Cache Protocol (ICP), and it can be configured as a transparent cluster (for redundancy and scalability) with up to five other CacheRaQs. For the cluster

configuration, one CacheRaQ acts as a master server and routes traffic to the other members of the cluster, which provide the caching capability.

We liked the management options for this product more than those found in the other Squid-based boxes. The Web interface is handy and well designed, with topic buttons (Network Setup, Cache Setup, Cache Statistics) on the left, and the resulting frame on the right. Using the Web interface, administrators can look at summary cache statistics—as well as cache hits and misses, throughput, and latency numbers—for any day. You can also call up the number of bytes and requests made per client or per server for any day.



Compaq TaskSmart C-1200R/ICS

Tested configuration, \$10,340 list. Houston; 800-345-1518; www.compaq.com.

● Designed for branch offices and small data centers, the Compaq TaskSmart C-1200R/ICS uses Novell's Internet Caching System (ICS) and offers easy setup and administration. Note that the Dell unit, which shares the same Novell architecture, costs \$5,000 less, comes with two hard disks as opposed to the Task Smart's one—and outperforms the Compaq.

The TaskSmart includes a 450-MHz Pentium II system in a rack-mountable chassis, along with 256MB of RAM, two Compaq 10/100 NICs, and a 9GB LVD hot-swappable hard disk. (Compaq is the only vendor to offer hot-swappable hard disks at this product level.) Also included is Compaq's Insight Manager, a Web-based management tool with console sup-

port. You can also use this tool to manage all Compaq servers, corporate PCs, and networking products. Unlike the Linux-based Squid systems in this roundup, ICS runs on a version of the NetWare 5.0 kernel, using Novell's patent-pending Cache Object Storage; it can cache DNS, FTP, Gopher, and HTTP traffic.

Installation is straightforward with the TaskSmart. A command line interface is accessible via a standard VT100 telnet session or a null-modem connection, though users are encouraged to take advantage of the Java-based GUI. The Web interface is superior to most we reviewed, though not as impressive as the CacheFlow 500's.

The GUI provides access to a host of setup, diagnostic, and reporting features. ICS offers scheduled URL downloads, URL exclusion filters, and links to existing services for filtering Web content. A

On our performance tests, the CacheRaQ ran about three times as fast as our baseline system and faster than an untuned Squid-Linux box running on more powerful hardware. Its last-place performance among the other products we reviewed is likely a result of its less beefy hardware configuration. In all, the CacheRaQ 2 provides very good value for small-scale installations.—*Russ Iwanchuk*

High-End Carrier-Class Caching

High-end caching products, commonly referred to as carrier class, can be distinguished from the systems in this roundup by two key features: They include many more processors and a lot more disk storage space. The up-and-coming players in this demanding arena are CacheFlow, InfoLibria, Inktomi, and Network Appliance, though other well-known vendors, including Cisco Systems and Lucent Technologies, have also entered the market.

Until recently, carrier-class caching products were used primarily by ISPs at their network operations centers and POPs to improve performance. Placement within the network varies, but in a typical ISP scenario, caching boxes sit at the edges of the network to serve up Web pages as quickly as possible. To date, Inktomi has dominated this segment with its Traffic Server product line. The company's list of customers includes @Home, AOL, Concentric Networks, Exodus, and Yahoo!.

A new caching niche is developing, however, as corporations become increasingly wired. Thanks to the proliferation of Internet access, intranets, and extranets that connect branch offices and business partners, more traditional companies are expressing an interest in heavyweight caching software and appliances. In these implementations, caching servers may function as front ends to Web server farms that house companies' public or internal Web sites (this is called *reverse proxying*). Or they may be set up at branch offices to speed access to frequently needed reports or critical data on the corporate intranet.

Besides having slightly different marketing strategies, these carrier-class vendors vary in terms of products and underlying technology. Unlike the products we review and discuss in this story, Inktomi's Traffic Server 3.0 (\$24,000 list) is not a hardware appliance but a software package. Traffic Server runs as a

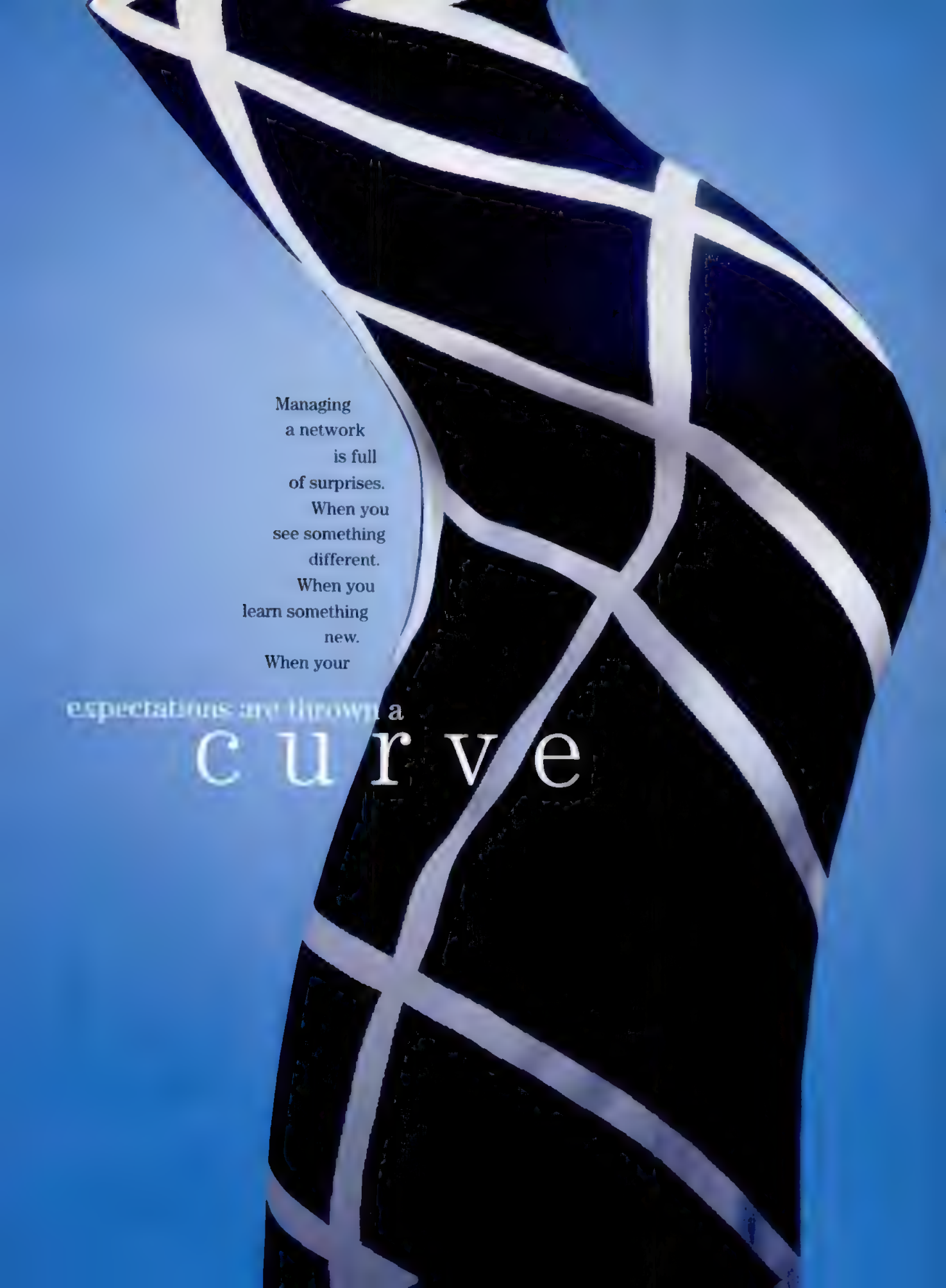
standard server on a range of platforms, including Digital Unix, Free-BSD, Sun Solaris, and Windows NT; the amount of available storage depends on individual hardware configuration. Like Network Appliance, Inktomi partners with Webspective to handle content synchronization and distribution across caching servers. And thanks to its relationship with RealNetworks, the company has recently released a streaming media caching module, which is available for \$4,000 list.

The CacheFlow 5000 (\$79,995 list), which was unveiled in late spring, can hold up to 63GB of data and can handle up to T3 (or 45-Mbps) Internet connections. The product's expansion shelf lets you scale the appliance up to accommodate OC3 (or 155-Mbps) connections and 180GB of disk storage. The CacheFlow 5000 uses the same technology found in CacheFlow's four other products—*adaptive refresh*, which intuitively updates cached Web pages, and *object pipelining*, which transmits Web pages in their entirety as opposed to object by object.

Relative newcomer InfoLibria released its DynaCache product line this spring. Its top-tier model, the DynaCache 200-14, sells for as much as \$95,000, depending on the configuration. InfoLibria's products use what the company calls a distributed cache architecture. The product consists of a hardware box and software that sits on a separate server; the two communicate to keep cached pages fresh and to make sure request loads are balanced among the DynaCache appliances.

The Network Appliance NetCache C780 (\$80,000 list) stores up to 495GB of data and can accommodate up to two T3 (45-Mbps) connections. The NetCache engine is based on the Harvest Cache, which came out of an early-1990s project funded by the Defense Advanced Research Projects Agency (DARPA). Harvest Cache also serves as the basis for Squid, the freeware software caching engine.—*Sarah L. Roberts-Witt*



An abstract graphic on the right side of the page, featuring a dark, textured background with several thick, white, curved lines that intersect and overlap, resembling a network or a stylized map. The lines are set against a solid light blue background.

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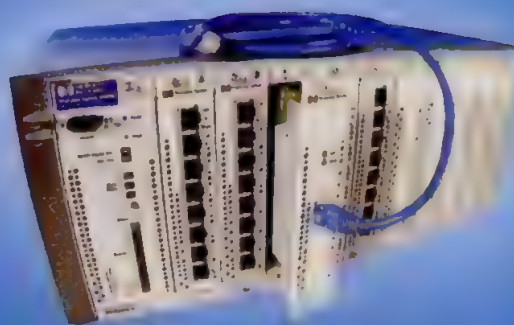
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BENCHMARK TESTS

Cache Appliances



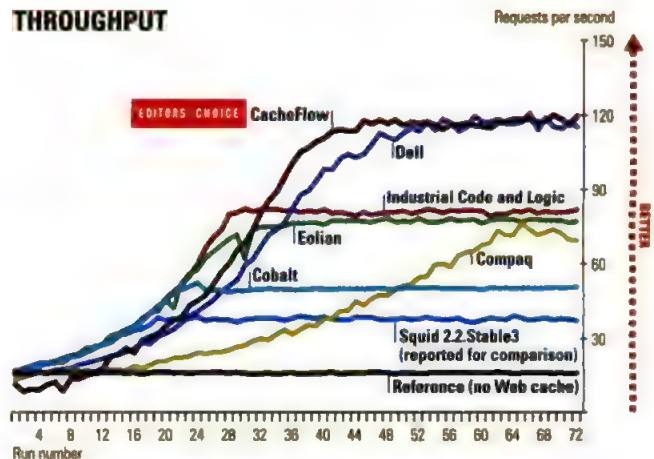
The CacheFlow 500 and Dell PowerEdge ICS1300B posted top-notch throughput and latency scores.

To test the browsing acceleration these systems can bring to a network, we built a test network that simulated several Web clients simultaneously requesting pages from a Web server across a typical WAN connection. With ZD WebBench 3.0, we then measured the throughput (rate at which clients received data, measured in requests per second) and latency (time clients waited for data, measured in milliseconds) of their requests, to gauge the before-cache performance. Finally, we dropped each cache appliance into the network, reran our tests, and compared the results with a network server running the Squid open-source caching engine. Each product significantly improved performance with respect to our no-cache reference test. Compared with the expense of buying additional bandwidth, a Web cache appliance is a relatively inexpensive way to improve speed.

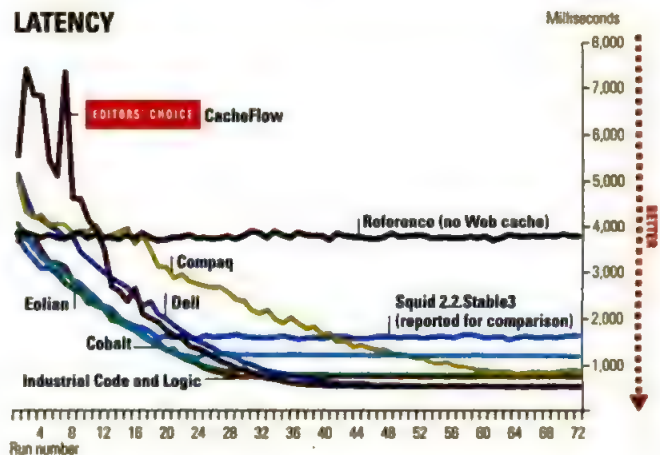
On our tests, more and more Web content was cached as the number of runs increased, resulting in increasingly better throughput and shorter latency. When the throughput and latency curves flatten out to their maximum and minimum, respectively, 80 percent of the Web content (the maximum cacheable with the content we used on tests) is being served from the cache rather than over the WAN. For more detailed testing information, go to www.pcmag.com.

—Analysis written by Russ Iwanchuk and Andrew Garcia

THROUGHPUT



LATENCY



Health page shows the validity of the cache's connections and setup parameters. Administrators can download URL access logs or monitor disk and CPU utilization, cache hit rates, and requests per

second. restore the cache to its previous specifications.

On our labs, the TaskSmart, showed a fivefold improvement over baseline performance—similar to the top scores we saw from other single-spindle appliances. The TaskSmart did appear to have some disk-transfer problems, however, as performance was unusually sluggish when the cache was full. We recommend that users get the latest ICS Service Pack, as the factory-installed TCP/IP stack drastically hampered performance over our T1 connection.—Andrew Garcia

Dell PowerEdge ICS1300B

Tested configuration, \$5,299 list. Round Rock, TX; 888-560-8324; www.dell.com.

● For its initial splash into the server appliance market, Dell has taken advantage of the success and reputation of its PowerEdge server line. The new Dell

PowerEdge ICS1300B, marketed to education networks, branch offices, and small POPs and ISPs, sells for \$5,299, and promises great value, smooth implementation, and easy administration. Though it's very similar to the Compaq offering, its competitive price and additional hard disk make the ICS1300B a better value.

Powered by Novell's Internet Caching System (ICS) software, the ICS1300B includes a 450-MHz Pentium III processor, 256MB of RAM, two 9GB Ultra-2 LVD SCSI disks, and a pair of Intel Pro 100+ NICs, bundled in a mini-tower chassis. Dell also offers an ICS1300A model with 128MB of RAM and a single 9GB hard disk, for \$4,499. With both models, Dell bundles its OpenManage Server Assistant package and ample hardware documentation. Like the Compaq offering, the ICS1300B can cache DNS, FTP, Gopher, and HTTP traffic.



Downloadable software upgrades are performed through the GUI. In case of catastrophic failure, an image of the factory-installed software is included on the CD. With a user-created configuration-settings disk, you can

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Expandable Cache Services

Cache appliances are certainly a good way to smooth out an end user's Web experience, but they are not the only way. Several new companies, including Akamai Technologies, SandPiper Networks, and SkyCache, now provide services that can complement existing caching infrastructures.

Designed to solve the problem of Internet content distribution, these newcomers push information to end users, either by distributing servers around the Internet or by updating cached data using satellite technology. Both Akamai and SandPiper are targeting their respective FreeFlow and FootPrint services directly at content providers and online publishers. They count the CNN Web sites, E! online, LATimes.com, and The New York Times on the Web among their customers. Businesses can use these services to improve Web site performance either on an ongoing basis or for special high-demand events. For example, LATimes.com, used FootPrint to accommodate the deluge of requests for the Starr Report last fall.

Akamai and SandPiper have almost identical infrastructures. Both have servers scattered throughout the Internet on which copies of their customers' data are replicated. The biggest difference between the two services for now is that SandPiper claims to have 400 such servers, whereas Akamai estimates it has 600 servers installed. Thanks to a recent agreement with Inktomi, however, SandPiper's servers can communicate with Inktomi's Traffic Server caching products, hence expanding the reach of the FootPrint service.

In addition, these technologies help determine how servers can handle requests most efficiently. FootPrint, for example, constantly scans the Internet for network outages and traffic bottlenecks. That information is then converted into dynamic routing

tables that the servers use to determine the best path for accessing requested pages. Akamai's real-time network map accomplishes the same tasks.

As for pricing, SandPiper charges \$2,000 per month for 1 Mbps of bandwidth; volume discounts are available. In addition to the static content portion of FootPrint, a streaming media component became available this summer. Akamai's FreeFlow also starts at \$2,000 per month for 1 Mbps; volume discounts are offered. Akamai is unveling StreamFlow, a streaming media distribution service.

As you may gather from the name, SkyCache relies on satellite broadcast and some patent-pending technology to improve user response times around the Internet. Unlike Akamai and SandPiper, SkyCache is marketing its service directly to ISPs; there are currently 120 signed up in the United States and Europe. The company intends to broaden its reach to other types of customers as well.

SkyCache offers two core services—satellite Usenet News feeds and Cache Turbocharging, which are based on proprietary reactive caching technology. Basically, SkyCache has a group of servers that continuously comb the Internet looking for popular, frequently accessed Web pages. These servers then aggregate what they've found, fetch the appropriate pages, and transmit that information via radio frequency to satellites on which SkyCache has rented space. Those satellites then broadcast the data to every SkyCache customer simultaneously. All the customer needs is a dish on the roof; SkyCache charges a one-time setup fee of \$1,000 and then \$500 per month for use of the dish and the service. Like Akamai and SandPiper, SkyCache has plans for a streaming media solution. —SLRW

The ICS1300B features a GUI that is nearly identical to the one Compaq provides. Dell provides easier access to the command prompt, however, through its available VGA and keyboard ports. Setup from the command line takes a little longer than from the GUI, as the commands are unfamiliar and a little clunky. Other similarities to the Compaq unit include software features, online help, diagnostic utilities, upgrade capabilities, and reporting. The only noticeable difference is that the Compaq seems to have fleshed out ICS's SNMP support to a greater extent. In both cases, the vendors are

relying on their hardware experience and reputations to add value to the ICS software, which they enhance to only a minimal degree.

The ICS1300B performed exceptionally well in our labs, posting numbers comparable to CachFlow for throughput and latency. The numbers are a little misleading, though: Most participants supplied only one hard disk with their configuration, but Dell doesn't offer a box with 256MB RAM and only one disk, so we tested with both disks. Novell expects a 5:8 performance ratio between one and two spindles in an ICS cache; with one disk, we would expect the

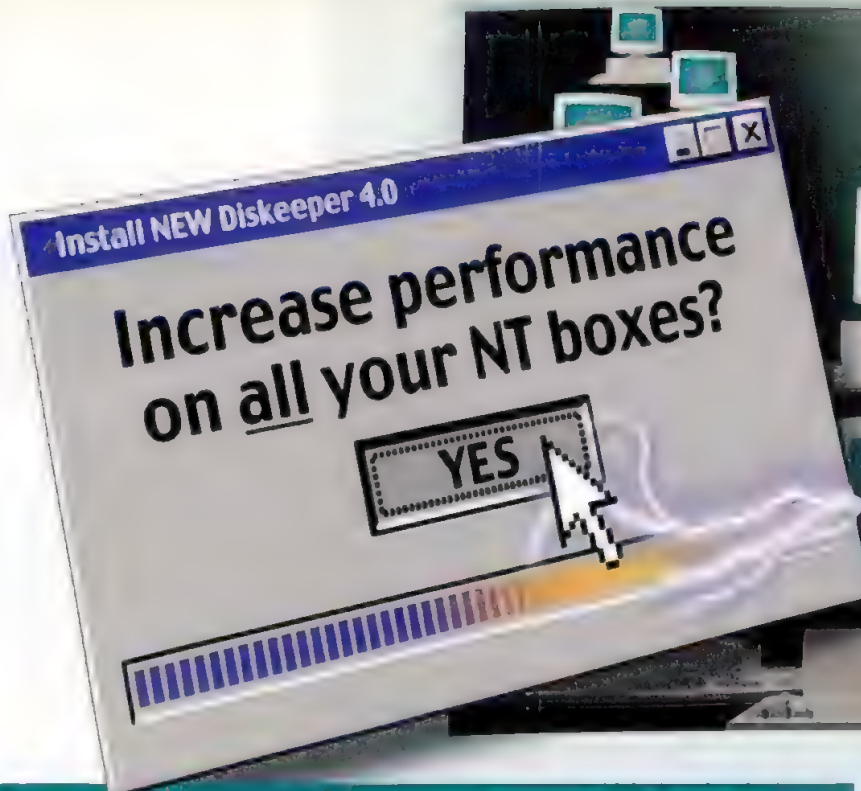
Dell would post numbers similar to the Compaq. Make sure to have the latest ICS service pack installed to avoid any TCP/IP problems. Overall, given the similarities between the Compaq and Dell offerings in terms of expected performance and features, the aggressive pricing of the Dell ICS1300B tips the scales in its favor. —Andrew Garcia

Eolian InfoStorm R1

Tested configuration, \$9,000 list. Fairfax, VA; 703-385-7322; www.eolian.com.

● One of the three systems in our roundup to be based on Linux and Squid, the Eolian InfoStorm R1 adds an additional twist by offering a cache appliance bundled with the EagleWatch caching service that purportedly provides performance gains (EagleWatch is a subscription service that manages page-freshness parameters). Though one of the most expensive servers in our review, we found the InfoStorm to be a good performer, nearly mir-





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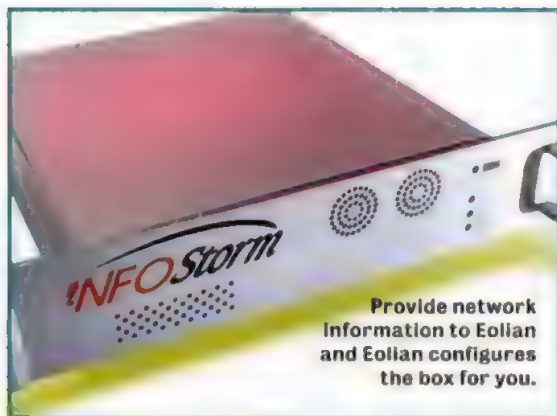
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roring the results of the Industrial Code and Logic offering. Eolian takes a unique preconfigured setup approach and offers basic monitoring capabilities, though it doesn't match the management schemes found in other products, such as the CacheFlow 500.

The InfoStorm R1 is the entry-level model of a family of products that are all optionally 19-inch-rack-mountable. Like most products in this roundup, the InfoStorm relies on Intel architecture, using a Celeron 433-MHz processor along with 512MB of RAM, a 10/100 Fast Ethernet connection and 18GB of disk space. For clustering a group of InfoStorms, Eolian's optional Redirector (\$4,000 list) load-balances performance and provides fail-over to protect against downtime.

To set up the InfoStorm, you first provide your network information to Eolian, including IP address, DNS, and routing information, so the system comes ready to plug in and operate. This makes the install procedure painless and less prone to error. But you can't change these basic settings or the device's security parameters without the Linux command line instructions.

For fault tolerance, each unit contains software and hardware for monitoring via Watchdog timers. These timers will restart Linux or Squid to correct software problems or use the hardware to reboot the system in case of failure.

The browser-based management utility is basic and less mature when compared to the CacheFlow, Compaq, and Dell systems. But it does let you view text-based reports or statistics. You can, for example, view the cache-hit rate, the number of objects and megabytes transferred, and detailed server statistics. A

single, unified graphical display of information is currently in the implementation phase. The only interactive feature is the ability to update the freshness of your cache by checking for new pages that you request.

Performance-wise, though Eolian has opted for building on the Linux and Squid platforms, it claims to have optimized the environment to double the performance. On our

performance test this system proved to be a more than able performer, with five times the peak throughput of our baseline system, though it was 30 percent below the leading Dell and CacheFlow. —JGW

Industrial Code and Logic WebSpeed Model 16000

Tested configuration, \$4,800 list. Cambridge, Ontario, Canada; 519-651-2713; www.indcl.com.

● Industrial Code and Logic (ICL) has put together the best-performing Squid-based Web cache in our roundup with the WebSpeed Model 16000. At \$4,800, the WebSpeed is on the less expensive end, and the GUI and management features do lag a bit behind those of other units.

Like the CacheRaQ 2 and InfoStorm products, the WebSpeed is built using NLANR's open-source Web cache software (Squid, Version 2.2), and runs Linux 2.2.7 for its operating system. It's a rack-mountable box, with good physical security in the form of a locking faceplate. The unit we tested came with a 400-MHz Intel Pentium II processor, 256MB of RAM, two Intel 10/100-Mbps Ethernet cards, and two Ultra2-LVD disks—a 4.5GB disk for the OS and logs, and an 18GB disk for Squid's cache. ICL offers several cache appliances, ranging from the \$2,100 Model 2000 with 2GB of cache to the \$7,200 Model 24000 with 24GB of cache.

Installation and setup of the WebSpeed went quickly and without a hitch, though we preferred the elegance of Cobalt's procedure. The first step is to boot the WebSpeed with a monitor and keyboard attached. After Linux boots up, you are presented not with a shell prompt

but with a seven-item pick list containing various configuration and system-maintenance options (such as shut down and restart). You must also specify the NICs in use, which can get annoying if you change network information with any frequency.

The WebSpeed can operate in a transparent mode as well as in the traditional proxy mode, and it supports ICP for participating in cache-peer relationships and hierarchies. It also allows file redirection, meaning a request for certain large files is redirected to a local source.

Management options available through the browser interface are useful, but not quite as extensive as those found in CacheOS- or Novell ICS-based solutions. The top page contains helpful 30-day statistics on daily request rates and cache-hit ratios, and grants access to the last seven days' reports. Reports contain detailed daily statistics and provide breakdowns of protocol usage, server usage, and URL types, and include graphical representations of system performance statistics graphed over the course of a day. There's also a "WebSpeed Configuration" link, from which you can change system settings such as the IP address, proxy port number, and access-control lists. For users comfortable with Linux, full command line access is available from the pick-list interface.



The WebSpeed cranked out the best scores in the roundup for a Squid-based unit, performing five times as fast as our baseline. It was 5 percent faster than the next-closest Squid competitor, the InfoStorm, but about 30 percent below the performance leaders from CacheFlow and Dell. —RI/PC

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Shareware Awards

We present the winner in each of eight software categories, including our over-all favorite, SpamKiller, which makes quick work of junk e-mail.

By Sheryl Canter

Even if you're a newbie, you've probably heard of—and encountered—spam, unsolicited bulk e-mail that clogs your in-box and burdens ISPs by hogging bandwidth and storage space. Now there's a solution: Novasoft's SpamKiller, the winner of the 1999 PC Magazine Shareware Awards contest, lets you fight back by automatically deleting spam and sending out removal notices and complaints according to options you've set.

The PC Magazine Shareware Awards contest, now in its sixth year, recognizes the year's best PC-based shareware products. This year we considered 40 finalists from eight categories—business applications; desktop accessories; e-mail, news readers, and chat; file utilities; graphics and multimedia; HTML editors; Internet utilities; and Web development. The *PC Magazine* contest is part of the larger Ziff-Davis shareware competition sponsored by ZDNet (see www.zdnet.com/swlib/zdwards/zdwards.html for more information). To be considered for an award, programs had to be significantly updated or newly submitted to the ZDNet Software Library (www.hotfiles.com) between April 7, 1998, and April 14, 1999. Winners were announced on July 22, 1999, at the Shareware Industry Conference in Tampa, Florida. As you'll see in the pages that follow, we found a number of exciting products.

BUSINESS IS BOOMING

The phenomenal growth of the Internet continues unabated, and that's good news for the shareware industry. Today, shareware is distributed mainly on the Web, and the low cost of entry enables even small software publishers to enter the market. That's good for consumers, too. It encourages innovation, and the "try before you buy" marketing means you can experiment with a variety of software titles without spending any money.

Our Judges: Winners were chosen by *PC Magazine* contributing editors SHERYL CANTER, ED MENDELSON, LUISA SIMONE, CRAIG STINSON, and DAVID STONE.



Download the winners and finalists
at [www.pcmagazine.com/
shareware99](http://www.pcmagazine.com/shareware99).

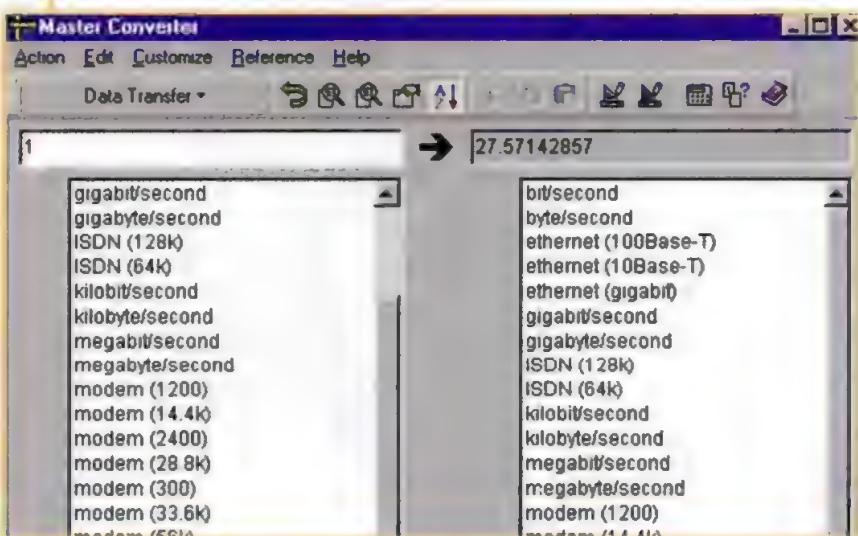


That doesn't mean the software is free. If you intend to keep it, you're expected to pay. Still, shareware products usually cost a fraction of what their commercial counterparts cost. Often you'll receive a more fully featured version of the product and perhaps a disk and manual when you pay for and register your software.

To foster quality standards, the Association of Shareware Professionals has developed guidelines for both authors and distributors. For more information, visit its Web site at www.asp-shareware.org. Note that shareware shouldn't be confused with the growing open-source movement, which aims to make source code freely available to developers (for more information see www.opensource.org).

That the shareware industry is booming is clear from both the quantity and quality of this year's entries. SpamKiller and the winners in the other seven categories are reviewed below. For a list of all 40 finalists with brief descriptions of what they do, see the sidebar "PC Magazine Finalists." You can download the programs by visiting PC Magazine Online at www.pcmag.com/shareware99. No matter where your interests lie, you're sure to find some handy additions to your computing toolbox.

BUSINESS APPLICATIONS: Master Converter, Version 2.10



Some utilities offer to do everything but fold your laundry. Master Converter devotes itself to a single task: converting numbers from one unit of measurement to another. The program is preconfigured to convert more than 800 units in 33 categories. There are the categories you'd expect, such as speed, temperature, volume, length, and time. Other categories are culled from specialized areas of mathematics, physics, and engineering—dynamic viscosity and angular velocity, for example. Some categories are computer-related. You can find out how many floppy disks it takes to hold the data of one CD-ROM (467.2258518) or convert between data-transfer rates. The program will also do simple tasks like converting numbers from one base to another, or from fractions to decimals and vice versa.

Currency is not one of the preconfigured categories, because exchange rates fluctuate constantly. But it's easy to add new categories as needed and to add or modify the units in a category. A table of metric prefixes can help you get your terminology right, and a built-in calculator is available for quick conversions.

Master Converter doesn't do anything particularly difficult or tricky, but it is a time-saver and a convenience. If you frequently need to convert one unit to another, you'll appreciate this well-designed utility.

Master Converter, Version 2.10. \$15 direct. Savard Software, Tri-Cities, WA; 509-736-6342; www.savard.com.

TravelJack, Version 3.0

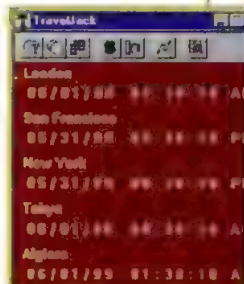
If you do a lot of traveling or phoning across time zones or national borders, TravelJack can help ease the transitions. Its main window displays the current time and date in up to ten cities. You can use the comparison feature to see the current time and date in any two cities without adding them to the main window. Cities are grouped by country, and this can create confusion for U.S. cities, because some city names appear in more than one state. But you can add to the city list if you want or change existing items—for example, add the state to the city name.

TravelJack's currency conversion facility is especially handy—all the more because you can update the conversion rates from the company's FTP site. There is also a measurement conversion feature, which is not exhaustive but does supply the basics: volume, length, area, weight, and temperature. The measurement formulas and time zone data can also be updated from the company's FTP site. Just select the components you want to update and click the Retrieve button.

Keeping track of meetings and conference calls across time zones can be tricky. TravelJack's event notification facility lets you enter events in the local time of any city you choose and view an automatic conversion to your local time. Events can be flagged as daily, weekly, monthly, annual, or one-time. Event notification can be by message box, WAV file, program launch, or any combination of these. The calendar portion of the event scheduler lets you enter notes for each day.

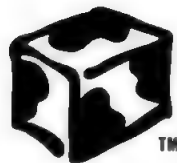
TravelJack makes it easier to keep track of time, money, measurements, and events across time zones and national borders.

TravelJack, Version 3.0. \$39 direct. Extension Software Inc., Mesa, AZ; 602-820-0321; www.extensionsoft.com.



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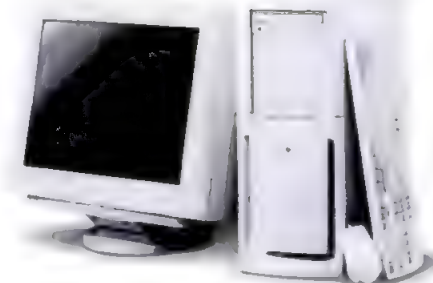
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E-MAIL, NEWS READERS, AND CHAT:

SpamKiller, Version 2.55



This well-designed program supports Internet (POP3) e-mail and MAPI e-mail (used on many corporate networks) and can handle multiple accounts. A well-designed configuration wizard walks you through the setup. Once configured, SpamKiller sits in the system tray and periodically checks your mail servers for incoming spam.

SpamKiller uses filters, rather than huge lists of e-mail addresses, to identify spam. Filters can apply to any part of the message—sender, subject, body text, country, or header. The Other category contains filters that screen out messages with invalid return addresses or recipient addresses that are not your own. The built-in list of filters is large and comprehensive and is periodically updated by the company. You also can add your own filters. To protect against mistakes, deleted messages are saved locally for a user-specified period of time.

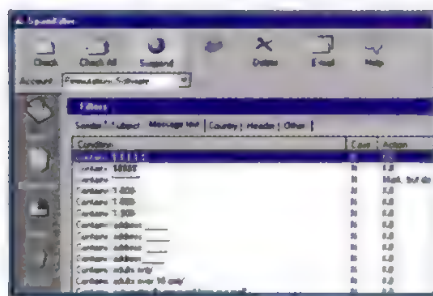
You have several options for handling spam once it is identified. You can kill it, mark it without killing it, accept it, kill it after complaining, or kill it after requesting that your name be removed.

A Friends list—designating people from whom you'll always accept e-mail—can be built by importing address books from a variety of different software packages. You also can add and remove names manually. The Friends list always overrides the filter criteria.

SpamKiller accomplishes its purpose with comprehensiveness and style. It is our overall winner in this year's contest.

SpamKiller, Version 2.55. \$29.95 direct.

Novasoft, Trondheim, Norway; www.spamkiller.com.

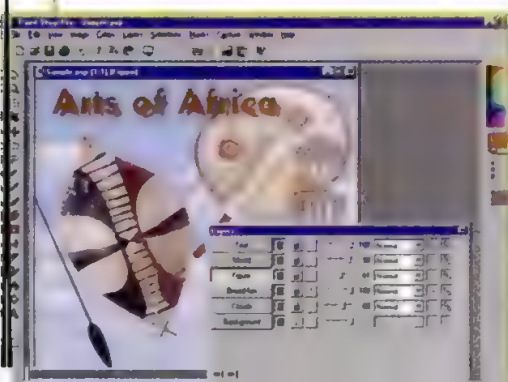


GRAPHICS AND MULTIMEDIA: Paint Shop Pro, Version 5.03

Paint Shop Pro offers powerful image-editing and photo-retouching tools in a user-friendly package. Even if you don't need its more sophisticated features, you'll appreciate the simple advantages over Windows Paint. Paint Shop Pro's ability to zoom out as well as in lets you crop large images that are unmanageable in Paint. Also, Paint Shop Pro supports over 40 graphics formats and offers a batch-conversion feature.

Professional graphic artists will also find what they need in Paint Shop Pro. Images can be enhanced in a variety of ways. Along with the standard image filters like Gaussian Blur and Sharpen, there are special effects filters such as Buttonize and Chisel. Picture

Tube brushes let you paint with a sequence of images. Support for multiple layers lets you create composite images with transparency locking and variable opacity. You can add to or subtract from select areas and save select areas for later use. You can separate an RGB composite image into four channels for CMYK, although you can't edit a CMYK composite image. For those who want to create animated graphics for Web applications, Paint Shop Pro is bundled with



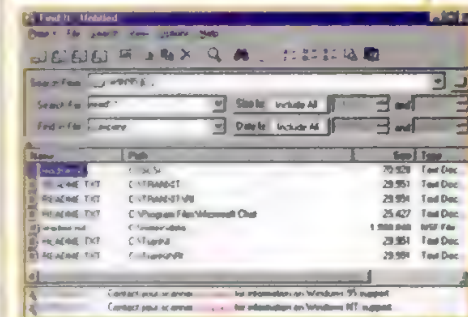
FILE UTILITIES:

Find It, Version 3.0

Find It is a file search utility that offers all but one of the features in the Microsoft Windows Find utility (it can't search for files by type) plus a few features that MS Find lacks. For example, you can select multiple drives to search simultaneously. Also, you can search for files whose size falls between two boundaries, whereas MS Find only lets you search for files that are larger or smaller than a set amount. When a search is complete, you can send the results to your printer, the Windows Clipboard, or a text file.

Find It lets you save search parameters in a project file, which is useful for searches you need to perform periodically. Unfortunately, the extension that Find It uses for its project file (.fnd) is the same one used by MS Find for saving search parameters and results. Because Find It overwrites the file association in the registry, saved search results from MS Find will no longer launch Explorer.

Like the Windows Find utility, Find It lets you search for files that contain specified text strings. The Find It program improves on the Windows utility in two ways: Find It lets you search for whole words only, and when you highlight a file name, Find It shows you the found string in context. This means you can quickly and easily identify the correct file, which you can then open by double-



clicking on it in the Found File list.

Find It offers several advantages over the Windows Find facility, and it is especially useful for searching for files that



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Left to right: Compaq AlphaServer, Compaq ProLiant, Compaq NonStop Himalaya



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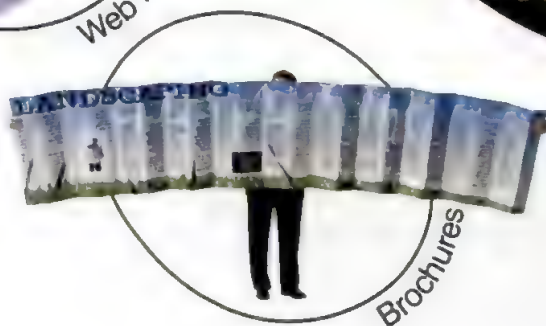
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PC Magazine Finalists: 1999 Ziff-Davis Shareware Awards

Listed below are the 40 finalists in the 8 categories judged by *PC Magazine*. The winner in each category appears in bold type; the overall winner is shown in red type. Download links for all the finalists are available from PC Magazine Online (www.pcmag.com/shareware99).

BUSINESS APPLICATIONS

Archivista	Archivista GmbH	Scan documents for electronic storage and retrieval.
ClipCheck	Most Media and BabyFace Software Inc.	Spell-check text you copy to the clipboard.
Email Address Pro	A1 Soft	Organize e-mail addresses and maintain mailing lists.
Manifest TimeTrap	Entertec	Track billable time by client and type of task.
Master Converter	Savard Software	Convert more than 600 units of measure in 33 categories.

DESKTOP ACCESSORIES

calcAnt	Winfried Schottler	Annotate calculations and save the results.
Multilingual Speaking Clock	Leif Porsklev	Hear the time of day spoken in any of several languages.
Talking CD Alarm Clock	NexusMedia	Set periodic alarms using a variety of different sounds.
TravelJack	Extension Software Inc.	Convert to local time, currency, and measurements.
WinGlobe	Dirk Djuga	Get coordinates, population, and local time for any city.

E-MAIL, NEWS READERS, AND CHAT

Calypso 3	Micro Computer Systems Inc.	Use an e-mail client with filtering and bulk e-mail support.
ICQ	ICQ Inc.	Chat, send messages or files, play games, and more.
mIRC	Khaled Mardam-Bey	Chat using a powerful but friendly IRC client.
Pegasus Mail	David Harris	Use a free e-mail client with built-in NetWare support.
SpamKiller	Novasoft	Automatically handle spam with flexibility and ease.

FILE UTILITIES

AudioCD MP3 Studio	PTS-Software	Record MP3 and WAV files to CD-Rs.
File-Ex	Cottonwood Software	Add features to File Open and File Save dialog boxes.
Find It	Raymond J. Province	Find any type of file fast, and save your results.
PKZIP/PKUNZIP for DOS	PKWare Inc.	Compress and extract ZIP files from a DOS prompt.
Space Hound	Fineware Systems	Free up hard disk space by eliminating unnecessary files.

GRAPHICS AND MULTIMEDIA

IconForge	CursorArts Co.	Create and modify all types of icons and cursors.
IrfanView	Irfan Skiljan	View any type of image, and play audio files.
Paint Shop Pro	Jasc Software Inc.	Create, edit, and add special effects to graphics files.
SuperSonic	Morton Software Development	Use a virtual audio rack to work with sound files.
Winamp	Nullsoft Inc.	Use a feature-packed and configurable MP3 player.

HTML EDITORS

CoffeeCup HTML Editor	CoffeeCup Software	Use libraries of JavaScript code and DHTML snippets.
HomeSite	Allaire Corp.	Write code with the aid of pop-up hints and wizards.
HotDog Professional	Sausage Software	Easily navigate files, and color-code by tag or syntax.
ixla Web Easy	IXLA Limited	Use a wizard-based interface aimed at beginners.
WebScripter Plus	Code Generation	Create mouse-overs and more with JavaScript wizards.

INTERNET UTILITIES

FTP Voyager	Rhino Software Inc.	Use an Explorer-like interface for FTP file transfers.
GetRight	Headlight Software	Schedule downloads followed by automatic log-off.
Internet Graphics Finder	SkibbySoft	Locate and view images on the Web.
MP3 Fiend	Eternal Software	Use 11 search engines to locate MP3 files on the Web.
VisualRoute	Datametrics Systems Corp.	Find the missing link when you can't connect to a site.

WEB DEVELOPMENT

GDIdb Pro	Global Data Industries	Place any ODBC database on your Web site.
Perl Builder	Solutionsoft	Use wizards to create Perl scripts, then add custom code.
Scribbler	CreamSoftware	Edit JavaScript, VBScript, and DHTML code.
WebData	Robert Young	Add a database written in Perl to your Web site.
Web Development Kit	Cripton Corp.	Create HTML with variables that expand into code.



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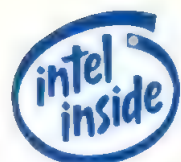
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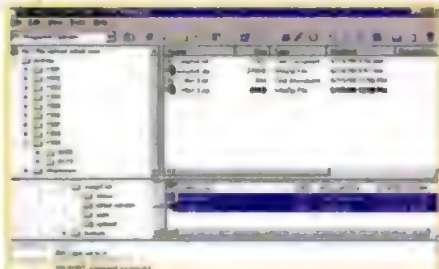
INTERNET UTILITIES:

FTP Voyager, Version 6.1.0.1

Whether you're maintaining a Web site or just downloading the occasional file, you'll appreciate this beautifully designed FTP utility. Combining a familiar, Explorer-style interface with a powerful feature set, FTP Voyager is the tool of choice for file transfer.

The program's three-pane window displays a tree view of the FTP site, a tree view of your local hard disk, and a log of the FTP messages sent and received. To transfer files, simply drag and drop them between panes or between instances of the program. Version 6.1 adds server-to-server transfer capability. Uploaded files retain the original date and time stamps, rather than being reset to the time of the upload. You can resume aborted transfers and synchronize local and server directories with a mouse click.

FTP Voyager comes preconfigured with a large number of FTP sites in a well-designed database. Sites are organized in a tree view, with categories on the left. The right side of the window displays the properties of the highlighted FTP site. If you've been using another FTP



utility, you can probably import your site list; half a dozen popular formats are supported.

Of course, there is support for proxy servers. You can enter a series of custom commands to be run after connecting to the FTP server. Passwords can be encrypted. You can create filters that determine which files are displayed in the right-hand pane.

In short, FTP Voyager can meet the demands of sophisticated users, but it's also the best choice for basic tasks.

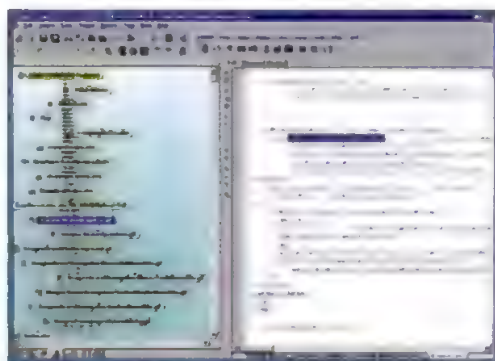
FTP Voyager, Version 6.1.0.1. \$37.95 direct. Rhino Software Inc., Gaylord, MI; 517-732-8856; www.ftpvoyager.com.

HTML EDITORS: HomeSite, Version 4.0

HomeSite is a code-based HTML editor with a wide array of productivity tools. The main window displays a resource panel on the left and an editing panel on the right. The resource panel can display file lists, HTML tags, the table of contents for the online help file, reusable code snippets, or a Site View map of your Web site. The editing panel lets you toggle between documents, using tabs along the bottom of the window, and switch views (Browse, Design, or Edit), using tabs along the top.

The editor is enhanced with optional pop-up hints for completing tags, a spreadsheet-style display of tag attributes, and the ability to insert custom code snippets with hotkeys. The HTML commands are color-coded, and tags can be validated as you type. Wizards ease the designing of frames, tables, pop-up windows, tables of contents, and other complex elements. With the new CodeSweeper feature, you can impose your own formatting rules on pages created with other tools.

A Project Manager lets you group the different files that make up your Web site. You



can perform search-and-replace operations across all the files in a project, and you can verify a project's hyper-text links. The help file is a bit hard to navigate, and with the extensive feature set this can be frustrating. But on the whole, HomeSite is one of the best HTML editors on the market.

HomeSite, Version 4.0. \$89 direct.

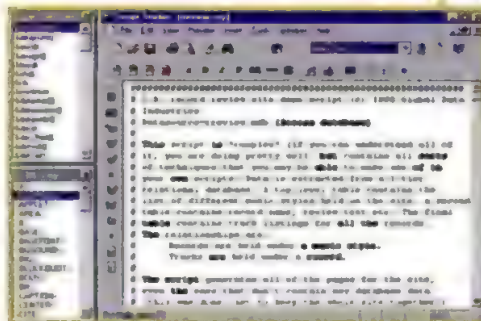
Allaire Corp., Cambridge, MA; 888-939-2545; www.allaire.com/products/homesite/index.cfm.

WEB DEVELOPMENT GDldb Pro, Version 5.0.1

GDldb Pro lets you convert ODBC-compatible databases and spreadsheets into HTML documents for publication on the Web. The pages it creates are static, but updating is easy. A built-in FTP facility lets you copy the generated HTML documents to your Web server. You can upload all the generated HTML documents or only those that have changed. For frequently updated databases, the entire process can be automated. You can also run GDldb Pro from the command line for use with external schedulers and scripts.

Conversion scripts can range from relatively simple to extremely complex. A Script Wizard lets you create standard scripts without learning the GDldb Pro script language. To control the appearance and structure of the generated HTML pages completely, use Script Studio to edit the script manually.

GDldb Pro's clean interface gives access to a lot of power. A small window has two toolbars for running scripts, previewing projects in a browser, and uploading HTML pages to a server. You can launch Script Studio from the toolbar of the main window. To the left of the edit window are two lists: script functions and HTML tags. Double-click on any item and it will be inserted into the edit window. The edit window also offers



dockable toolbars for quick access to the most commonly used functions and tags.

This package isn't for beginners or casual coders, but it offers a way to publish databases on the Web with a minimum of expense.

GDldb Pro, Version 5.0.1. For noncommercial use, \$76 direct; for commercial use, \$220. Global Data Industries, Swindon, Wiltshire, U.K.; www.gd-ind.com.



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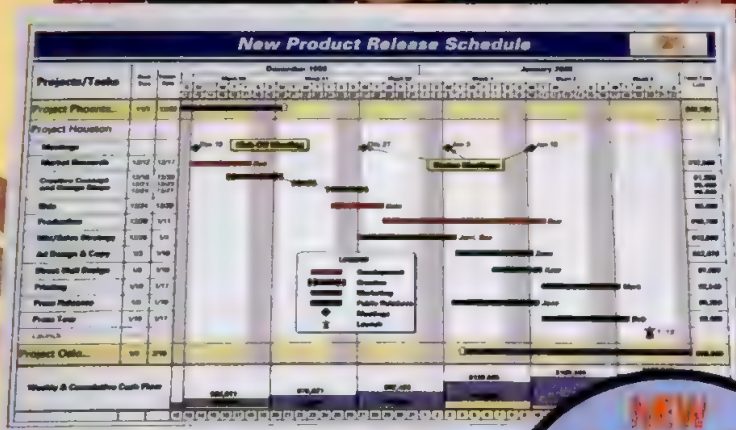
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TUTOR

Multiple Monitors



More is better than bigger: Multiple display support in Windows 98 and Windows 2000.

By Neil Randall

We all want that gleaming new 19- or 21-inch monitor. We want it for all kinds of reasons, but mostly so that we will have more room on our Microsoft Windows desktops. That means being able to open more programs and documents, display related program windows side by side, and gain greater control over the work environment. But hey, those big, gleaming new monitors are expensive. For the \$600 to \$1,200 you'll have to spend, you could buy a whole new system.

Actually, there's a better solution: Instead of getting one large monitor, use two smaller ones. Think about it. If you now have a 17-inch monitor, buying a 21-inch gains you roughly 40 percent more area, while combining your 17-inch with a 15-inch monitor would net you about 75 percent more area. True, this also takes up more desk space, but for many of us, part of the desk is used primarily for piles of unnecessary stuff anyway. Furthermore, many of us already have a second monitor—the 14- or 15-inch model that the 17-inch replaced to begin with—so why not put it to use?

But how can you use two monitors on one PC? Windows 98 offers a feature called *multiple display support* (we'll call it *multidisplay*) that lets you use not just two monitors, but up to nine. Setting up a multidisplay Windows 98 system is relatively simple, and once you have it in place, all monitors are available as soon as Windows loads.

HERE'S WHAT YOU NEED

Here we'll examine a two-monitor system only. Setting up a multidisplay system with more than two monitors is no more difficult, it simply requires more equipment and more available computer resources (such as free IRQ settings).

First, a few words about the two monitors. They can be different sizes, and they can even support different resolutions. For example, your primary monitor might be a 19-inch model that you like to run at a resolution of 1,280-by-1,024, while your second could be an older, 15-inch model that looks best at 800-by-600. Color capabilities can also be different. As we'll see later, the multidisplay feature lets you set each monitor to its own best configuration.

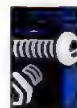
Second, you'll need two display cards. Each monitor requires its own AGP or PCI adapter (you cannot use ISA video cards in a multidisplay system), and if you're like many users, you have an older adapter sitting around doing nothing. Not all adapters will work for multiple display purposes; Microsoft offers an updated listing at <http://support.microsoft.com/support/kb/articles/q182/7/08.asp>, but the

USER TO USER

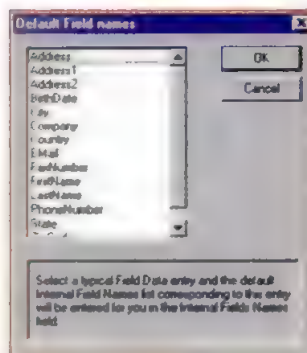


Printing page borders in Word 97; port problems when adding a second printer; get rid of an annoying window that pops up at Windows NT startup; determine your Windows 95 system's Y2K readiness; automatically select an entire Excel row; shade alternate rows in Access reports. *Page 197.*

UTILITIES



How many times have you entered your address, phone number, e-mail, and other information on Web pages? Our free utility, FormWhiz, fills in entire Web forms automatically, once you've entered the required data. *Page 205.*



PC TECH

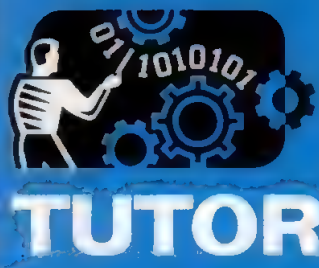


Windows Help is fast giving way to another Web-influenced trend: HTML Help. Why use a separate hypertext system when HTML has become so ubiquitous? Microsoft HTML Help extends straight HTML with context-sensitivity, standard navigation controls, and more. *Page 209.*

More on the Web:

You'll find all of the articles, examples, and code files in this section at PC Tech online.

www.pcmag.com/pctech



TUTOR

company admits that display adapters may work even if they don't appear in the listing. Like it or not, the only real way to determine whether your multiple monitor system will work is to give the system a try.

You'll also need a free adapter-card slot in your system for the display adapter and a free IRQ setting that the display adapter can use. The IRQ setting might very well be where the

ing the case. And while you're at it, blow some of the dust out of the machine.

Step 2. Connect the monitors to the video cards, and turn on the computer. One of the monitors will show the boot sequence while the other will remain dark. The readable monitor is your *primary* display, and the dark one is the *secondary*. The slot into which you insert the new card determines which monitor Windows considers the primary. Typically, the card closest to the power supply acts as the primary display adapter, but your system might be different. Unfortunately, there's no real way to check this until you turn on your computer and see which monitor displays the boot-up text.

You'll want your higher-quality adapter and monitor to be primary, because if you disable multidisplay support at any time, only the primary display will remain active. At this point, you might need to power down, open the case, and reverse the order of the adapters to ensure that

the primary and secondary displays are established as you want them.

PART 2: CONFIGURE WINDOWS

Now that you've completed the hardware installation, it's time to tell Windows how you want to use your second monitor.

Step 1. It's now time to start Windows. Power up the computer and both monitors and let Windows load, paying special attention to the text message on your *secondary* monitor. The message tells you that Windows knows the video card and monitor are present, and that you can activate the secondary monitor through Control Panel.

Troubleshooting: If the desktop appears on the primary monitor and nothing shows on the secondary one, then Windows doesn't see your secondary video card or monitor. In such a case, first make sure the monitor is functional by connecting it to the primary video card. You need to shut down and power down the system before swapping the connection. And before doing that, you need to set your video mode to something available on the secondary monitor. The safest setting would be a lowest-common-denominator one, like 640-by-480, 256-color mode.

If the monitor works, the problem lies with the video card. Power down, open the case, and check all connections (including whether

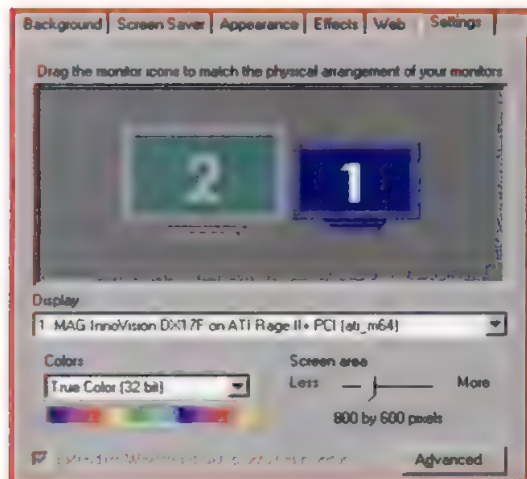


FIGURE 1: When you install a second monitor, the Settings tab of the Display Properties dialog box shows the arrangement of the monitors.

whole idea falls apart, given the tendency for today's computers to use all possible IRQs not only for the standard functions such as hard-disk adapters and serial/parallel ports, but also for hardware such as internal modems, DVD cards, sound boards, and so on. Once again, though, the best idea is simply to try and see whether your PC can recognize both display adapters.

PART 1: ADD A VIDEO CARD AND MONITOR

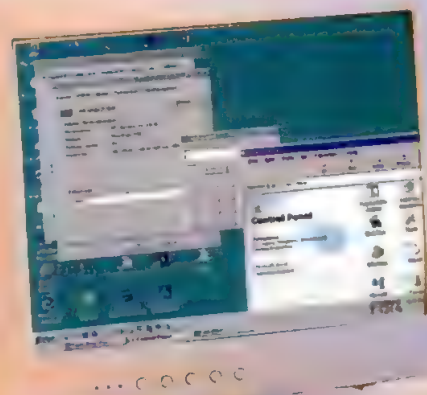
This is by far the most demanding part of the multidisplay setup, but until you complete it, nothing further can happen in the process. The procedure is not complex in any way; it's demanding only because you have to be comfortable opening your computer case. As with any hardware installation, you may need to troubleshoot if things don't work properly. Chances are, however, that everything will work just fine from the beginning.

Step 1. Open the computer case, insert the second video card into an appropriate peripherals slot (AGP or PCI), and then close the case. Of course, you should practice the same safety techniques you would when adding any hardware device. Remove the power cord, and ground yourself with antistatic sheets or wrist bands; ensure that screws don't fall into the case (very important), and check that all components are securely seated before clos-

Uses for Multiple Monitors

You're not alone if you've never considered attaching a second monitor to your system. But there are some very real benefits. In fact, once you use two monitors, you'll find it difficult to go back to just one. Here are some possible uses:

- **E-mail:** Keep your e-mail program open on your second monitor so that you can see it at all times.
- **Research:** If you're researching from the Web or a CD-ROM, move the research items or the launch pages to the second monitor for continuous reference.
- **Editing:** If you're editing a word processing document heavily or combining two documents into one, use the second monitor as a place to keep the original(s) in view, so that you can refer to them quickly.



Here you see the Control Panel, spread across two monitors, with the Display Properties dialog behind it on the first monitor and a Help screen behind it on the second.



Then power up once more to see whether the problem has been fixed. If not, repeat the process after putting the video card in a different slot. If it still doesn't work, remove the primary video card and boot with only the second card to determine whether the card itself is functional. If it works, then you probably have a video card that will not work with Windows' multidisplay feature, and the only thing you can do is get a new card.

Step 2. Go to Control Panel and double-click the Display icon. In the *Display Properties* box, click the *Settings* tab. You can also call up this box by right-clicking on the desktop away from an icon and selecting *Properties* from the resulting menu.

Step 3. Under the *Settings* tab (shown in Figure 1), you see a representation of the two monitors, with the primary display labeled "1" and the secondary display "2." The *Display* field shows the name of the primary display system's monitor and video card. The primary monitor is selected (its icon is highlighted); only the selected monitor's properties show in the bottom half of the dialog. The secondary monitor appears faded, which means that it is disabled. The two monitors are displayed side by side, but you can arrange them in any manner you wish (discussed later in this article).

Step 4. To enable the secondary monitor,

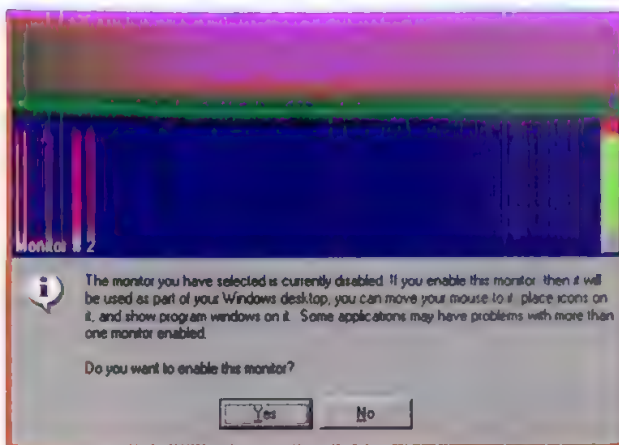
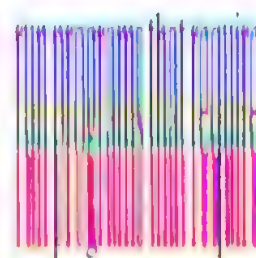


FIGURE 2: Windows presents this informative dialog box when you first activate a second monitor on your system.

click on its icon in the *Display Properties* dialog. This yields an information dialog (shown in Figure 2), which tells you that the monitor is disabled and asks whether you wish to enable it. Click the *Yes* button to do so.

Step 5. The secondary monitor is now the selected monitor, and the *Display Properties* dialog changes to reflect that selection. The *Display* field in Figure 3 shows the secondary video card and monitor, although in this particular case, the precise monitor must still be selected by clicking the *Advanced* button and then the *Monitor* tab in the resulting dialog. You can also change the resolution and color configuration for the secondary video system through the *Screen area* and *Colors* boxes.

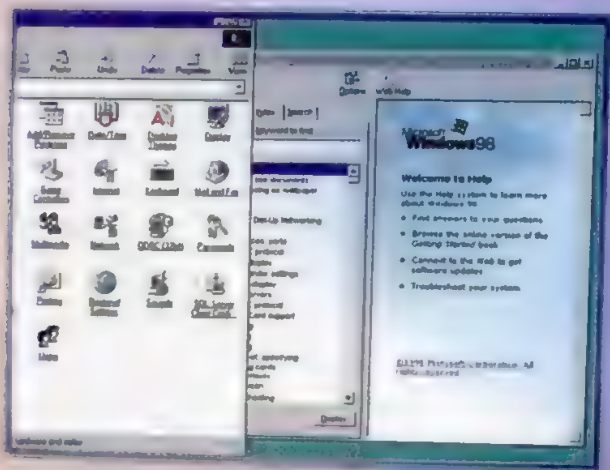
Configuring different monitors for different resolutions and color depth is, in fact, one of the most important features of Windows' multiple-display support. This feature lets you



one configuration on one monitor and those that require a different configuration on the other. You might need high resolution and True Color for your graphics program, but perhaps not for a word processor. In fact, some programs require

lower resolutions or color depths to run properly, and some monitors and video cards don't support higher resolutions and numbers of colors. Another benefit of this feature is that you can test designs across different resolutions by simply dragging the designed item to a differently configured monitor.

Step 6. In Figure 3 we see the displays of the two monitors arranged vertically. By dragging the icons, you can arrange them however you wish, including diagonally. Normally, you'll want to display them in the dialog to match the physical configuration of the two monitors (the way they're positioned on your desk). The side-by-side arrangement of monitors is the most obviously practical. You're not restricted to arranging the monitors in the dialog box the same way they're actually arranged on your desk, but if you don't, moving windows from one monitor to the other will probably seem unnatural.



• **Spreadsheets:**

If you're performing a "what-if" analysis with a spreadsheet, put a copy of the original on the second monitor so that you can see the changes easily.

• **Surfing:**

If you're exploring several Web sites at once, give yourself two or three easily viewable Web displays at once, so that you can work with one while the others download.

• **Graphics:**

If you're working with a graphic in small detail, expand it across the two monitors to avoid scrolling and resizing.

• **Gaming:**

If you're playing a game with a cluttered display, expand it across the two monitors for greater clarity.

• **System monitoring:**

If you need to monitor your computer or network, keep the monitoring tools on the second display for easy access as you work.

• **Drawing:** In drawing or CAD programs, keep your drawing on the main screen and the con-

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Step 7. You move windows from one monitor to the other by dragging them off the edge of the first screen in the direction of the second. As you drag the window off the first monitor, you'll see it begin to appear on the second, and you can leave one or more windows displayed across the two monitors. In effect, multidisplay support simply extends the Windows desktop across multiple monitors. It does not create separate desktops. (Note that the desktop icons appear only on the first monitor; you can move these to the second if you wish, but when you reboot they'll reappear on the first.)

Troubleshooting: One of the reasons to be careful of the monitors' arrangement in the *Display Properties* dialog is that you can drag a window so that it's not accessible at all. If you have your monitors arranged side by side, for example, and you drag a window downward off the primary monitor, you can drag downward past the taskbar until the window is no longer accessible, even if you hide or move the taskbar. Fortunately, you can recover the window without rebooting: Select *Start | Settings | Taskbar & Start Menu*, then under the *Taskbar Options* tab toggle the *Auto hide* feature either on or off (whichever it currently is *not*). Click *OK* and the window will reappear.

As the sidebar "Uses for Multiple Monitors" demonstrates, there's most likely a way that multiple monitors can benefit you, no matter what you do with your PC. **PC**



FIGURE 3: You can rearrange the placement of monitors, as shown here, and adjust settings for the highlighted monitor, in this case, monitor 2.

Neil Randall is a contributing editor of PC Magazine and author of *The Soul of the Internet*.

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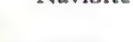
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USER TO USER

Print Page Borders in Word 97

I have not been able to print a page border in Word 97 successfully. When I add a border with **Format | Borders and Shading**, the border shows on-screen, but when I print the document or choose **File | Print Preview**, the bottom line is missing. I've tried this on two ink jet printers with the same result.

Microsoft support said the problem is caused

whether the information is right or not.

Ink jet printers are often unable to print on part of the top and bottom of the page. This results from the printer's need to hold on to the paper. Any paper-feed mechanism may have to advance the paper beyond the top of the page to hold on to it, and the mechanism may not be able to keep holding on near the bottom of the page.

It's true that printer drivers don't always provide the correct information to Word about their nonprintable areas, an issue that often affects footers that appear in that area. But you can easily find out whether your printer has a nonprintable area. And if it does, you can compensate by adjusting your settings to make sure that Word doesn't try to print there.

Start by loading Word and choosing **File | New** to create a new blank document. Next choose **File | Page Setup**, then **Margins**, and set the top and bottom margins to 0. Choose **OK**. Word may warn you that your margins are set outside the printable area of the page (see Figure 1). If it does warn you, choose **Ignore**.

Next, set the font and size to whatever you normally use, and enter a number in each line, entering enough to spill over at least ten lines onto the second page. Typically, you'll wind up with about 70 numbered lines on the first page.

Now print the document. When you give the print command, you may see a dialog box warning you that the margins are set outside the printable area and asking whether you want to continue. Answer yes. The output will show you where the nonprintable areas are. In tests with an Epson Stylus Color 3000, for example, the printer skipped the first line of the page and missed the last 2.5 lines, so the first line printed was 2 and the last was 66. Only the top half of the 67th line printed.

With the printed output in hand, you can use either the line count or a ruler to determine where the top and bottom margins

should go. For the Epson printer we ran our tests on, nothing prints on the first line (roughly the first quarter-inch) or the last three lines (roughly the last half-inch). These numbers give you the minimum size for the top and bottom margins. If you use headers or footers, the margins should be larger still. The positions for headers and footers—which are measured by the distance from the edge of the paper—should be set farther from the edge than where the nonprintable area starts. As with margins, headers and footers are set through the **File | Page Setup** command.

You can also use this information to set page borders. If you choose **Format | Borders and Shading**, then **Page Border**, you can define the type of line, color, width, and so on for the borders. To define the border positions, choose the **Options** button. This will show you the settings for the top and bottom margins (the distance to the border) and a setting called *Measure from*, which tells Word whether to measure the top and bottom border margins from the edge of the page or from the text.

By default, each page border is set to print at 24 points (0.33 inches) from the edge of the page. So if the nonprintable area starts one-third of an inch or more from the top or bottom, the border won't print on that edge. You may be able to fix this by changing the top or bottom setting, but the maximum in both cases is 31 points (0.5 inches). So if the nonprintable area is 0.5 inches or more, you won't be able to adjust the position enough to get the border to print.

The fix is to set the border to print at some number of points from the text instead of *Edge of page*. Then adjust the top and bottom margins through **File | Page Setup** to ensure that the distance between the text and the border leaves the border within the printable area on the page. With the Epson printer, for example, we were able to print the bottom border by choosing **File | Page Setup** and setting the bottom margin to 0.75 inches, then choosing **Format | Borders and Shading | Options** and setting the border margin from 1 to 13 points from the edge of the text. That's just under 0.25 inches from the text, which, with a bottom margin set to 0.75 inches, translates to just over 0.5 inches from the edge of the paper.—M. David Stone

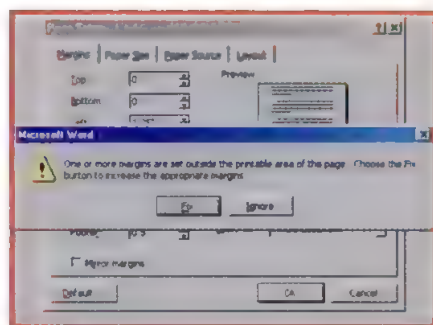


FIGURE 1: Word displays this warning when you set margins too small. You can take advantage of doing so to find a printer's true limit.

by the printer drivers giving the wrong information about the nonprintable area on the page. I'm not sure what that means, because I don't understand why an ink jet printer shouldn't be able to print anywhere on the page. I tried choosing **File | Page Setup** and changing the bottom margin to a larger value, but the border still doesn't print. Does Microsoft's explanation make sense? And regardless, is there anything else I can try to make this feature work?

Paul Edwards
via the Internet

PC The problem is a common one for ink jet printers. Microsoft support is only partly right about the cause, however. In some cases, the issue is not that Word gets the wrong information from the driver but that you have to adjust the border position manually,

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Parallel-Port Problem

My original LPT port used I/O address 378h, and my Zip Drive and printer worked just fine. Then I changed it to 3BCh in order to use 378h for a newly installed LPT2 and 278h on LPT3. Now the

drive and printer on LPT1 return "can not locate" or "can not communicate with" error messages. Would uninstalling and reinstalling these devices reconfigure them to work with the new I/O address? Thanks for any help or advice.

Lance Shockley
via the Internet

PC You have to do more than simply change the port I/O addresses in Windows using the *Ports* properties in Device Manager. You must also configure the port itself to its new address. On older motherboards and some expansion cards, this means moving one or more jumpers. If the LPT1 port is built into your motherboard, you may need to reassign it using your system's CMOS configuration utility to change your BIOS settings. This should give you the option to choose a different I/O address for the port.

If you can't find a way to change the assignment, consider changing your first added port to 3BCh and making it LPT1; then let the original port become LPT2 with its original 378h assignment.

If you want to verify the I/O address assignments of your ports, you can do so using the Debug program (which you should find in the Windows/Command folder). When you run the program, you'll see its *ready* prompt: a dash. Type

```
d 40:0 L E
```

and press Enter to display 14 bytes of memory starting at the location 0040:0000. The first line will contain information similar to this:

```
F8 03 F8 02 00 00 00 00 - 78 03 00 00  
00 00 00 F7 01
```

The first four pairs of values represent the settings for the serial ports—COM1 through COM4—and the next three pairs represent the parallel ports. The least significant byte is listed first, so in the case shown here, LPT1 is assigned to 0378h. When you're finished examining the data, type Q and press Enter to exit Debug.—*Alfred Poor*

Unwanted Windows

For several months, I had an irritating Explorer window appear showing the System32 folder each time I logged on to my Windows NT 4.0 workstation. When I saw the article in your issue of February 9, 1999, about a similar problem, I decided to fix my system. Unfortunately, the Microsoft Knowledge Base article you cited is for Windows 95 only. After a little searching, however, I found a Knowledge Base article with



a fix for Windows NT, at <http://support.microsoft.com/support/kb/articles/q170/0/86.asp>. After reading the article, it took me only 5 minutes in the Registry to get my system working right again. Thanks for pointing me in the right direction.

Mike Spohn
San Clemente, California

PC The earlier article, found online at www.pcmag.com/pctech/content/solutions/oe1803b.htm, explains that extra spaces or a trailing comma in Win.ini's load= or run= lines could cause an unwanted Explorer window to open each time Windows starts up. Under Windows NT, a damaged, incomplete, or missing Registry entry can cause the same problem. The Knowledge Base article specifically warns about problems in the Registry keys HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run and HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Run. It's possible that a damaged entry under HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\RunServices could cause the same problem. These three keys define programs that Windows should launch at start-up.

Microsoft's suggested solution involves launching Regedit, navigating to each of the Registry keys, and examining the values they contain. The value display in Regedit's right-hand pane lists the names and data for the selected key. The problem is caused by null data, represented by a pair of quotation marks, or by invalid data, displayed as a pair of question marks. Microsoft specifically mentions the Registry value named ActiveMovie File Extensions but recommends deleting any value that has null or invalid data. The company also warns that Regedit itself can cause problems that cannot be solved.

In most cases, *PC Magazine's* Startup Cop utility, available on our Web site, can get rid of those unwanted Explorer windows without the risk of using Regedit. Launch Startup Cop, select each start-up program in turn, and activate the *Detail* window. Look for programs loaded from the Registry that have an empty command line. When you find such an item, use Startup Cop to disable it.—*Neil J. Rubenking*

Y2K for Windows 95

Here's an easy way to tell whether your copy of Windows 95 has been updated to Y2K compliance. If you applied the Microsoft Win95y2k.exe patch, it replaced Winfile.exe and Command.com, and if you type *dir /4* at a DOS prompt, you'll see that the file dates show four digits for the year:

Anthony M. Parson, Jr.
Berwyn, Illinois

PC It's true that the patch Win95y2k.exe replaces Winfile.exe and Command.com, but this patch has been superseded by W95y2k.exe, which updates quite a few more files. You can remove the older Win95y2k through the Add/Remove Programs applet, but not the newer W95y2k. If you haven't installed *either* patch, the *dir /4* command yields the error message Invalid switch - /4. If that command displays dates with four-digit years, you still need to check which patch was installed.

The article at <http://support.microsoft.com/support/kb/articles/q231/3/27.asp> in Microsoft Knowledge Base explains that the correct patch places a file named Y2kw95.txt in the Windows folder. It also lists identifying date/time and size data for a number of files updated by the patch. If the Y2kw95.txt file is absent on your system, another Knowledge Base article, <http://support.microsoft.com/support/kb/articles/q225/0/50.asp>, provides a link for downloading the latest Y2K patch.—*Neil J. Rubenking*

Select an Entire Row Automatically

I often use very wide Microsoft Excel 97 worksheets, and I need to see all the data in a particular row when I'm editing data in a particular cell. For example, let's say column A contains a customer name and column H contains the customer's phone number. If I'm looking at a phone number in H55, I like to take a quick glance over at the name in A55. To do this, I often find myself selecting each row as I work with it to make it easy to follow back along the row. Is there a way to have Excel make this entire-row selection for me automatically as I move from row to row?

Ajay Sinha
via the Internet

PC You can do this with an event-driven VBA procedure. But you probably also want the ability to turn this automatic row selection on and off at will, or you may find you have too much of a good thing.

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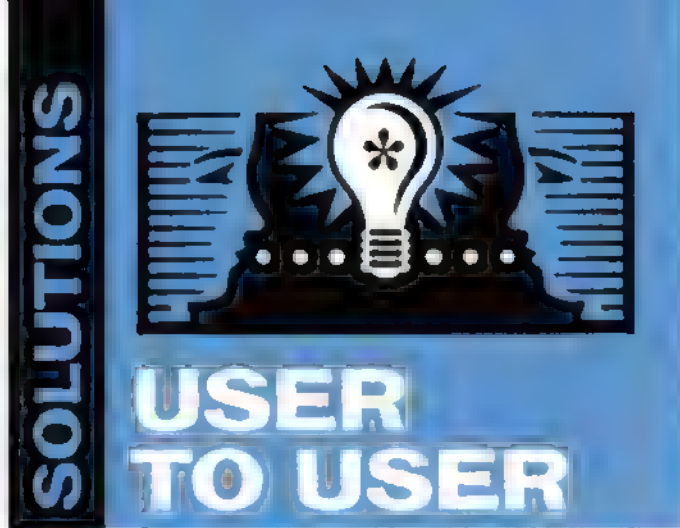


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The following few lines create a toggle macro that lets you turn row selection on and off:

```
Public Tog As Boolean
Static Sub Toggle()
    Tog = Not Tog
End Sub
```

The first line declares *Tog* as a public variable—meaning one that's available to the event-driven procedure that actually does the row selection. The *Toggle* subroutine itself is created with the *Static* keyword so that *Tog* retains its value from one execution to the next.

The event-driven procedure looks like this:

```
Private Sub
Worksheet_SelectionChange(ByVal Target
As Excel.Range)
    If Tog Then
        CurrentAddress = Target.Address
        Application.EnableEvents = False
        Selection.EntireRow.Select
        Range(CurrentAddress).Activate
        Application.EnableEvents = True
    End If
End Sub
```

The procedure does nothing if *Tog* is currently *False* (that is, if row selection is turned off). If *Tog* is *True*, the procedure stores the current address, turns off event trapping, selects the current cell's entire row, activates the current cell, and then turns event trapping back on again. The reason for all this is that the *EntireRow.Select* action always has the side effect of making a cell in column A the active cell. To override that effect, you need to store the current cell's address before selecting the entire row, then make that cell the active cell after the row has been selected. And because changing the selection is what triggers the entire-row selection in the first place, you need to turn off event trapping temporarily while you reactivate the appropriate cell.

For maximum convenience, create the toggle macro in a workbook that's present at every Excel session. You can do so by storing the workbook that contains the macro in your *Xlstart* directory, which must be directly below the directory that contains *Excel.exe*. (On my system, the pathname is *C:\Program Files\Microsoft Office\Office\Xlstart*, but it may be different on yours.) You may already have a workbook called *Personal.xls* there. If so, you can add the macro to that workbook. If not, create a workbook by that name (or any other) and

store it in *Xlstart*. (If you have a *Personal.xls* workbook, chances are it's hidden. Use Excel's *Window* menu to unhide it while you add your toggle macro.)

Follow these steps:

1. Open the workbook in which you want to store the toggle macro.
2. Press Alt-F11 to start the VBA Editor.
3. Choose *Module* from the *Insert* menu.
4. Type the code listed above.
5. Return to Excel, choose *Macro* from the *Tools* menu, *Macros* from the submenu, and *Toggle* from the list of macros that appears. Click the *Options* button, and assign a keyboard shortcut to the *Toggle* macro. This will enable you to turn row selection on and off with a keystroke.

You must create the event-driven procedure in the worksheet where it's to take effect. This means that if you want a dozen worksheets to have the row-selection feature, you need to create the procedure a dozen times. You'll want to copy the code to the Clipboard and make liberal use of the *Paste* command.

To assign the procedure to a worksheet, follow these steps:

1. Activate the worksheet in Excel.
2. Press Alt-F11 to get to the VBA Editor.
3. In the *Project Explorer* window (press Ctrl-R if you don't see the *Project Explorer* window), double-click the name of the sheet that you want the macro to affect.
4. At the top of the code window, you'll find two drop-down lists. Choose *Worksheet* from the left and *SelectionChange* from the right.
5. Between the top and bottom lines of the code stub that appears, type or paste the code listed above (beginning with *If Tog* and ending with *End If*).

Return to Excel, save, and you're set.
—Craig Stinson

Shading Alternate Lines in a Report

I am currently building a Microsoft Access database to house telephone information for all of our customers. I have put together reports to print out the information. Is there a way to shade every other line so that the reports are easier to read?

Brian Grant
via the Internet

PC You need to place the following code into the *Format* event of your report's *Detail* section:

```
Const Gray = 12632256
Const White = 16777215
If Me.Detail.BackColor = Gray Then
    Me.Detail.BackColor = White
Else
    Me.Detail.BackColor = Gray
End If
```

The *Format* event for each report section is processed when Access has gathered the information for the section but before the section is actually printed. The code above toggles the *Detail* section's background color between white and gray.

To place the code in your report, open the report in Design view and then double-click on the *Detail* bar. When the *Detail* section's *Properties* window appears, choose the *Event* tab and click in the text box for the *On Format* property. Next, click on the ellipses button, and when the *Choose Builder* dialog appears, select *Code Builder* and choose *OK*. Then place the code shown above between the following line

```
Private Sub Detail_Format(Cancel As
Integer, FormatCount As Integer)
```

and *End Sub*. When you're finished, close the report and save your changes.

Your report still may not print correctly, because the fields in your *Detail* section have solid white backgrounds against the gray shaded background on alternate lines. In this case, you need to make sure that each text box in your report's *Detail* section has its *Back Style* property set to *Transparent*.

Normally a text box's *Back Style* property is set to *Transparent* by default. For example, if you use the Report Wizard to generate a report, the text boxes will be created with a transparent back style automatically. If, however, the *Back Style* property of each text box is not set to *Transparent* for some reason, the background color for the *Detail* section (the gray background on alternate lines) will not show through, and your fields will all have solid box backgrounds.

To check the *Back Style* setting, select the field in the *Detail* section of your report, then select the *View* menu and choose *Properties*. Choose the *Format* tab and scroll down to the *Back Style* property. Change it by clicking in the text box and then clicking on the arrow to choose *Transparent*. When you're done, close the *Properties* window and save your changes.—Sal Ricciardi **PC**

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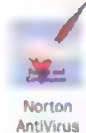
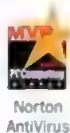
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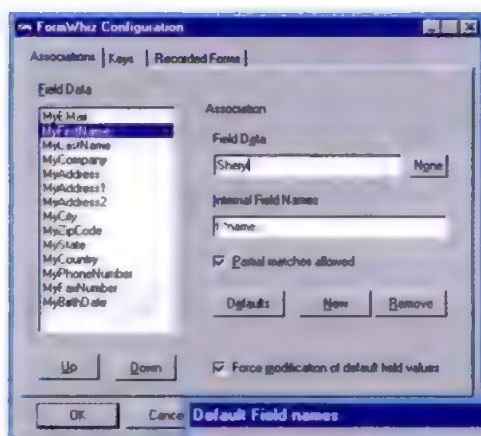
Fill In Web Forms Automatically

How many times during the last month have you entered your first name, last name, address, e-mail, and telephone number? This issue's utility, **FormWhiz**, does the work for you.

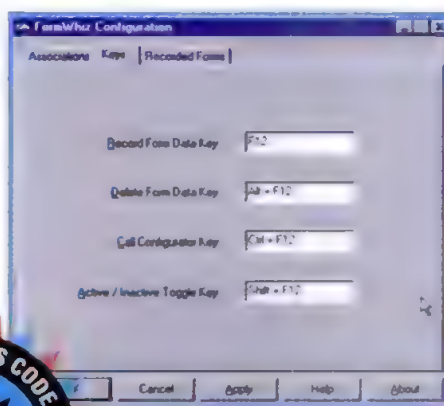
You enter the data only once, when configuring FormWhiz. Then whenever you load a form, FormWhiz uses this information to fill out the form automatically for you. Also, FormWhiz memorizes individual Web forms, which is useful for recording site-specific information.

FormWhiz runs under Windows 95, Windows 98, and Windows NT 4, with Internet Explorer 4 or higher. An article about how to use FormWhiz and how it was written is available on our Web site, at www.pcmag.com/utilities. A link to download the utility and its source code can also be found there.

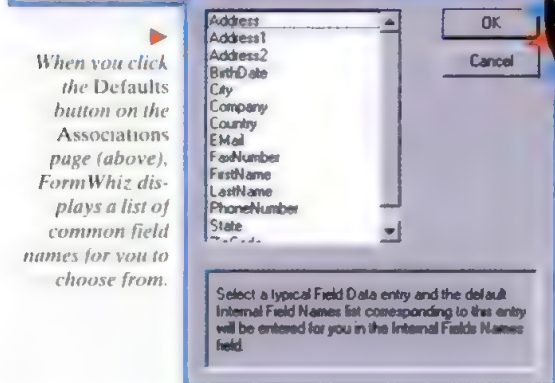
Patrick Philpott, the author of FormWhiz, is a developer based in Draveil, France. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.



FormWhiz lets you preconfigure your field data, entering values for all the fields you commonly encounter in Web-based forms. Fields are identified by their internal field names.



FormWhiz uses hotkeys to record forms, delete form data, invoke the Configuration dialog, or toggle between active and inactive states. You can set the hotkeys on the Keys page of the Configuration dialog.



When you click the Defaults button on the Associations page (above), FormWhiz displays a list of common field names for you to choose from.

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* SOFRES/InterSearch Windows OS User Reliability Study 16/98. Participants using Windows NT Workstation were about three times less likely to experience serious system stoppages than Windows 95 users surveyed.

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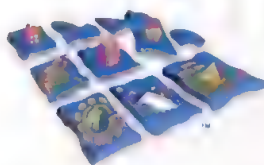
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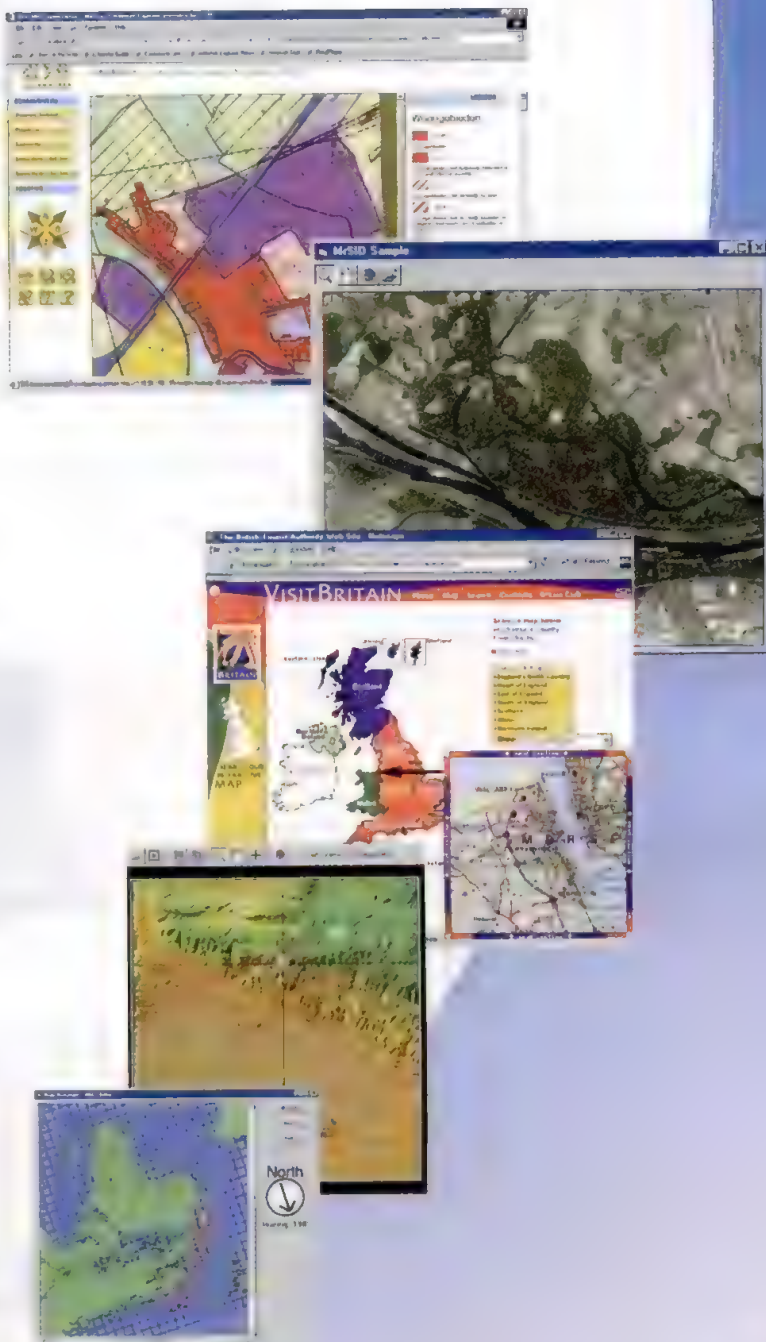
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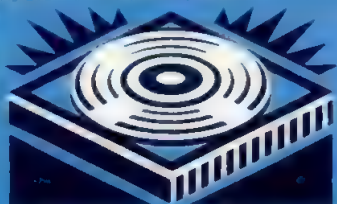


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PC TECH

Getting Started with Microsoft HTML Help Workshop

By Scott Boggan

The furious pace of Web development has left virtually nothing untouched, and not surprisingly, it's changing the nature of online help. This is especially true for Microsoft Windows applications, formerly the province of Windows Help (or WinHelp).

Early WinHelp files were little more than text linked to an application, but the release of Microsoft Windows 95 brought a vastly improved help engine and a seemingly bright future. About that time, Bill Gates began a push for Microsoft to embrace the Internet, and WinHelp was on his radar screen. In a lengthy memo entitled "The Internet Tidal Wave" (www.usdoj.gov/atr/cases/exhibits/20.pdf), he advocated a switch to browser-based help. This would let Microsoft consolidate its development efforts, and it would give users another reason to use Internet Explorer. Besides, HyperText Markup Language (HTML) was becoming the lingua franca of computing and would provide a more powerful platform for help.

Thus Microsoft HTML Help was born. All of Microsoft's major products now use HTML Help (including Windows 98, Office 2000, MSDN, and the upcoming Windows 2000), and though support among other Windows software vendors has been slower than initially anticipated, most have now jumped or plan to jump on the bandwagon. And HTML Help isn't just for technical writers and software developers: It's steadily gaining a foothold in corporate intranets, particularly for publishing large documents such as policy and procedure manuals.

HTML HELP BUILDING BLOCKS

For all its strengths, HTML is not well suited for publishing context-sensitive application help or large online documents. Accordingly, Microsoft's design extends standard HTML with several key features:

- standard navigation controls, including a table of contents, index, and full-text search.
- a customized interface that looks more like WinHelp than a Web browser, including customized windows and button bars.

- a context-sensitive API.
- a compiled file format that compresses and encapsulates HTML files and other data into a single file.

These additions expand the horizons of online publishing, but at a cost. Because compiled HTML Help files are based upon proprietary Microsoft technology—chiefly Internet Explorer (IE) and ActiveX—users must have IE 3.0 or above installed to view them. Furthermore, since essential HTML Help components (including ActiveX) aren't available on Apple Macintosh, UNIX, or Windows 3.1 systems, compiled HTML Help files run only on 32-bit Windows. Authors looking for a brows-

cations can communicate with the help system.

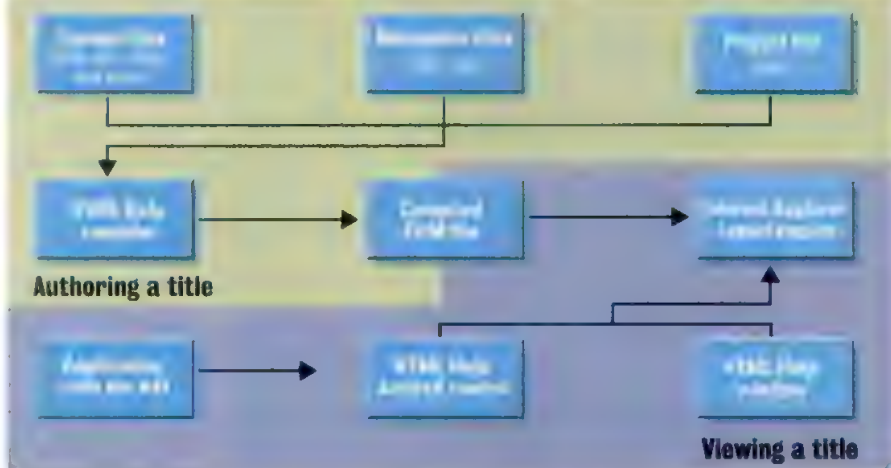
So how do you create an HTML Help file? The place to start is Microsoft's free HTML Help Workshop, which creates a help project and compiles it into a CHM file (<http://msdn.microsoft.com/workshop/author/htmlhelp/download.asp>—the downloadable file is approximately 4MB). This article walks through the process of authoring HTML Help using HTML Help Workshop. You'll find a sample HTML Help file containing code samples at www.pcmag.com.

HTML CONTENT AND THE PROJECT FILE

We'll assume here that you've already created your HTML content; you'll want a separate file for each topic in your help system. This can be done using a standard Web authoring tool or one of the many specialized tools dedicated to HTML Help (see the sidebar "HTML Help Authoring Tools").

When creating your help topics, remember that anything you can display in Internet Explorer is supported by HTML Help. In addition to standard text and images, your pages can contain multimedia, frames, forms, and custom scripts. Here's the upside to HTML Help's de-

Microsoft HTML Building Blocks



Here are the basic components for authoring and viewing HTML Help files.

er- and platform-independent solution must look elsewhere.

The diagram above gives an overview of HTML Help from two perspectives. From an author's standpoint, standard HTML content is supplemented with two navigation files and a project file. Run them all through the HTML Help compiler and you end up with a single, compressed file with a .chm file extension. On the viewing side, CHM files utilize IE's layout engine (Shdocvw.dll), along with HTML Help's ActiveX control (Hhctrl.ocx) and a few small add-ons. An API is also provided, so that appli-

cations can communicate with the help system. You can design pages without worrying about browser compatibility issues, and if you're targeting IE4 or above, you can safely use advanced features such as Dynamic HTML (DHTML) and Cascading Style Sheets (CSS). DHTML adds interactivity and multimedia effects to your pages; it's becoming an increasingly key ingredient in Help designs from Microsoft and others. CSS is particularly valuable in online help, where precise layout is important to maximize readability and conserve valuable screen space (see Figure 1).

Once your pages are ready, you need to cre-



ate a project file for the compiler to use when building your help system. The project file (which has a .hhp file extension) is a simple text file listing the names and locations of the files used in your project. It may also include a variety of options that customize the interface and behavior of your help system.

To create a project file, click **New** in Workshop's **File** menu. Provide the wizard with the names of your HTML files and specify a title for your project. When you're finished, your project file will appear in Workshop's left pane (Figure 2). Double-clicking an HTML file opens

Workshop's compression is very efficient, achieving an 8:1 ratio on HTML files. If any errors are found during the build (including missing files or broken links), Workshop displays a descriptive error message.

Once the file is built, open it by clicking the **View compiled file** button. Your CHM file will appear in the HTML Help viewer, but without any navigation tools it's certainly not very usable. Note that you can view the HTML source in such files by right-clicking a topic and then clicking **View Source**.

BUILDING NAVIGATION FILES

To make your help system both useful and usable, you need to provide a way to navigate between topics. You can think of this as binding a loose collection of pages into a book. Here's where HTML Help really shines. It provides three main navigation interfaces: a table of contents (TOC), a keyword index,

and a full-text search. The interfaces don't look that different, but they often appeal to different users. The table of contents is useful for presenting an overview of the content, especially for novice users. TOCs can quickly get very long, and usability studies show that most users prefer using the keyword index. A good index lets readers search for a word using a synonym (for example, *settings* or

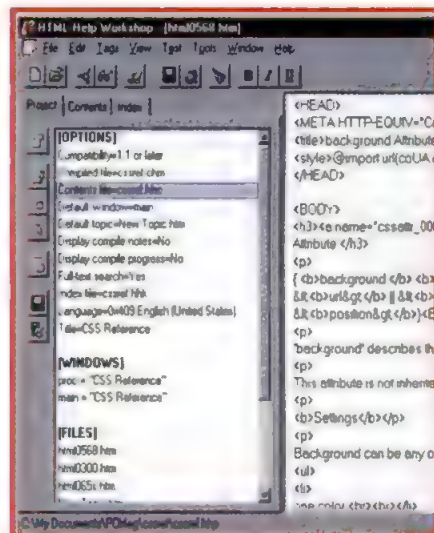


FIGURE 2: HTML Help Workshop is an authoring tool that builds compiled CHM files.

preferences), a phrase (such as *creating pages*), or even an inverted phrase (*pages, creating*). Advanced users often prefer the full-text search, just as they do on the Web.

We'll start by building the TOC and keyword index, both of which are created using a Microsoft file format called "sitemap." Sitemap files are based upon HTML's standard `<UL>` and `<LI>` tags, supplemented with OBJECT tags used by HTML Help's ActiveX control. Fortunately you don't need to create sitemap files by hand, although using Workshop to build them is still a tedious affair.

To create a "book" in your TOC, switch to the **Contents** tab, click the **Insert a Heading** button, and type the title you want to use. Next insert a page by clicking the **Insert a Page**

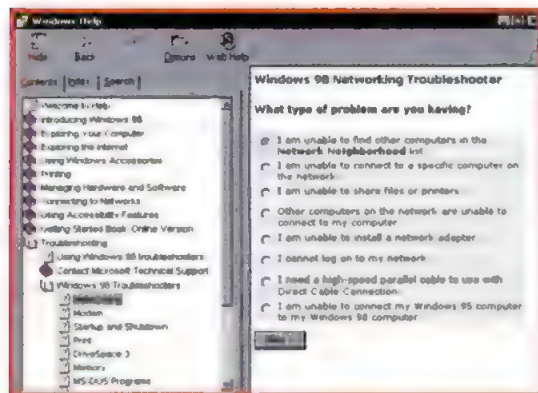


FIGURE 1: Microsoft HTML Help is the new standard for online documentation.

it in the right pane and displays its source code. Although you can use HTML Help Workshop to edit your HTML files, the program is not much better than Notepad.

Now that your project and content files are ready, build your help system by clicking the **Compile** button. This collects your HTML files, images, and any other content and compresses them all into a single CHM file. HTML Help

Browser-Independent Help

Compiled HTML Help is not a viable solution for everyone. A major hurdle is its dependence on Internet Explorer, which for some authors will create compatibility, distribution, or even political issues. Another limitation is that CHM files cannot be efficiently deployed on a Web server using HTTP.

There are alternatives suitable for general Web publishing, however, especially if you plan to deploy on an intranet. One approach is to use standard HTML frames to create an interface similar to HTML Help's window. Embed HTML Help's ActiveX control in the left pane to read your sitemap files, and display your content in the right pane. Though you lose many features (including full-text search and the context-sensitive API), this approach is Web-friendly and will really help users navigate a large document set (for an example, see the sample site at <http://msdn.microsoft.com/workshop/author/htmlhelp/sampleweb.asp>).

If cross-browser and cross-platform support are on your

checklist, you can extend this design with the addition of JavaScript and a Java applet. When the frameset opens, use a simple JavaScript to detect which browser is in use. If the user is running Netscape Navigator, simply load a Java applet instead of the ActiveX control. Many HTML Help authoring-tool vendors make Java applets that read the sitemap format (Microsoft even includes a Java applet with Workshop), so the extra work required is minimal. Some tools also create TOCs and indexes using DHTML, letting you sidestep Java performance and compatibility problems.

Some authors want it all: a full feature set—which includes a context-sensitive API, a custom viewer, and a compressed/encapsulated file format—as well as browser- and platform-independence. If that's what you need, JavaHelp from Sun Microsystems (www.javasoft.com/products/java/help) and Oracle Help for Java (www.oracle.com/products/tools2/ohj) are two packages that merit your attention.

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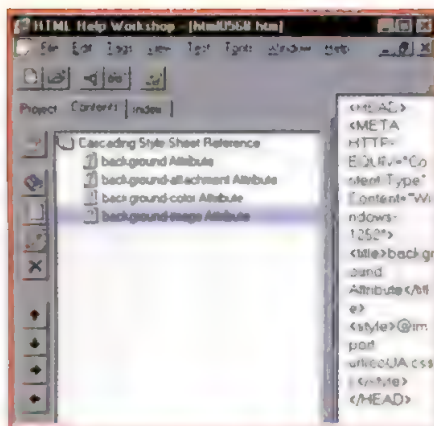


FIGURE 3: Building a table of contents in HTML Help Workshop involves creating a book and adding pages.

button, typing a title for the entry, and associating it with the name of the appropriate HTML file (see Figure 3). Repeat this for all of the pages in your topic and all the topics in your project, and then use the arrow buttons to arrange the TOC in the proper hierarchy. Click the **Save** button and Workshop saves your TOC as a text file with an .hhc extension.

The index is constructed much like the

table of contents but with more effort, because a single topic will usually be linked to several keywords. Switch to the *Index* tab, use the *Insert a keyword* button to enter a keyword, and associate the word with one or more HTML files. Create keywords for all of the topics in your project, but don't worry about sorting the list: The compiler will alphabetize them when it builds the CHM file. When you're finished, click the **Save** button to save your index with an .hhk file extension.

The final piece of the navigation troika is full-text search, and it's the simplest of the three to author: Go to the *Options* dialog box, click the *Compiler* tab, and check *Compile full-text search information*. This instructs the compiler to build the search database and include it in the CHM file. (Note that the search occurs on the client and does not require server software.)

Now build your Help system again, and voilà: The HTML Help viewer will sport three

navigation tabs. Click each of the tabs and test out your navigation.

ADDING LINKS AND POP-UPS

You've built a good framework for navigation, but adding links to your pages makes the system even more useful. In addition to standard Web links, HTML Help supports links that point to multiple topics. Such "one to many" links can help you avoid overwhelming users with long lists of topics. When clicked, this type of link will use HTML Help's ActiveX control to display either a dialog box

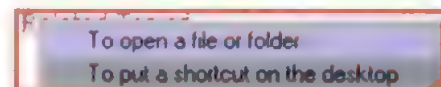


FIGURE 4: Related Topics links can point to multiple topics.

or a pop-up menu containing a list of topics, as shown in Figure 4.

To create a Related Topics link, open an HTML file and run Workshop's wizard by clicking *HTML Help Control* from the *Tags* menu. Choose *Related Topics* in the first screen, and in the next screen leave the *As a button* option selected. In the next screen, click the *Add* button and specify a title (it will

HTML Help Authoring Tools

Workshop will acquaint you with HTML Help, and the price is right, but for serious authoring you'll probably want to invest in something more powerful. None of the standard HTML-authoring tools support HTML Help's extensions, but there are several dedicated authoring tools from which to choose. These not only pay huge dividends when you're managing an HTML Help project, but they also automate the process of inserting ActiveX code into your pages, creating sitemap files and context-sensitive mappings, and building your project.

Currently, these tools fall into one of three general categories: native HTML authoring tools, database authoring tools, and tools designed for creating both printed and online help manuals.

RoboHELP HTML Edition, from Blue Sky Software (www.blue-sky.com), is a native authoring tool that provides an environment optimized for HTML Help. The tool supports both WYSIWYG and native HTML tag editing, making RoboHTML flexible enough to suit a wide range of experience levels.

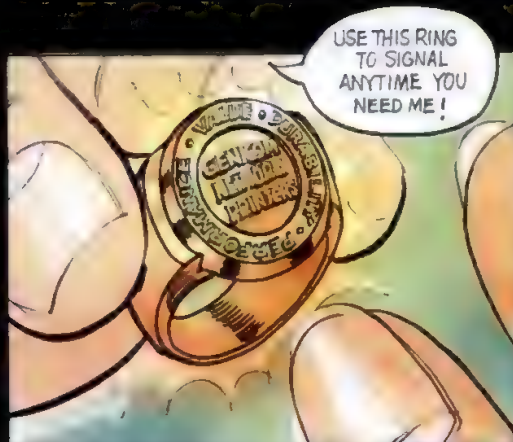
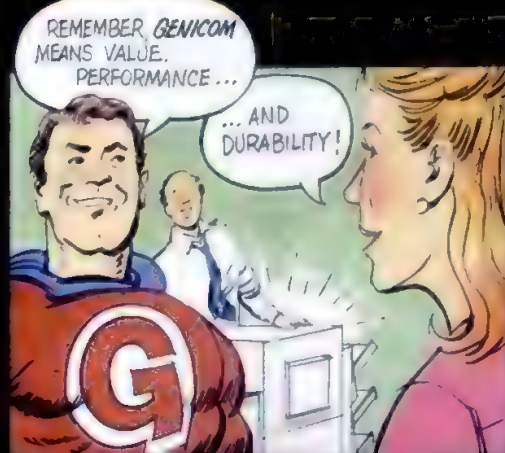
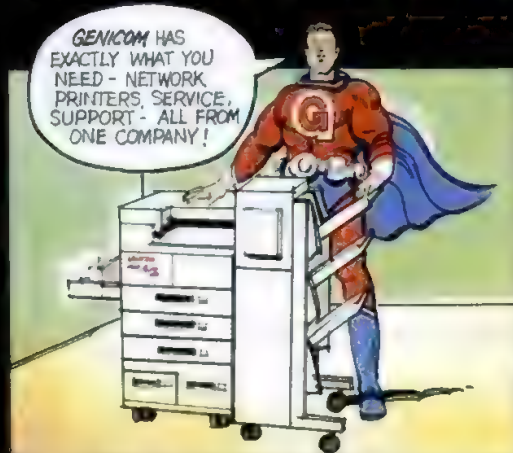
ForeFront's ForeHTML (www.ff.com) and **Virtual Media's HDK** (www.virtualmedia.com.au) are database-authoring tools providing a generalized WYSIWYG editor that isolates the author from the underlying mechanics of a particular technology. When you compile, information is extracted from a database and converted to HTML Help (or any of several formats, including WinHelp, standard HTML, or Sun's JavaHelp).

Doc-To-Help, from WexTech Systems (www.wextech.com), provides a similar ability to create multiple formats from a single source, but it is primarily designed as a single-sourcing tool. A

Doc-To-Help author creates a printed manual in Microsoft Word, using conditional tags to mark up hypertext elements. During the build process, the Word document is converted to either a printed manual or any of several hypertext formats. **WebWorks Publisher**, from Quadralay Corp. (www.quadralay.com), is another print-oriented tool that converts FrameMaker documents to any number of HTML-based formats, including HTML Help.

As you might guess, each of these tools offers a vastly different authoring experience. Your choice will largely depend on your experience level and the output formats you are targeting. If you want precision control over the output, a native authoring tool may be the best choice. Less techie types or authors looking for consistency across multiple output formats should investigate the database authoring tools. If you're creating paper and hypertext documents from the same source, a single-sourcing tool is the logical choice.

A few freeware tools will round out your help-authoring toolkit. **KeyWorks Software** provides a veritable Swiss Army knife of utilities for HTML Help authors, including **KeyTools** and **KeyHH** (www.keyworks.net). Written by Microsoft's original development lead for HTML Help, KeyWorks' products will help you optimize and test HTML Help files, and the tool adds cool features that extend Microsoft's platform. General Web authors should check out **HelpWare's FAR** (www.helpware.net/FAR); feed it a Web site and with just a few clicks you'll have a compiled HTML Help file. This is a great way to package Web content quickly and it's valuable for working on prototypes or creating downloadable versions of a site.



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PC TECH

appear in the pop-up menu or the *Topics Found* dialog) and an HTML filename for each topic you're linking to. You can link to as many topics as you wish. Click *Finish*, save the HTML file, and rebuild your Help system to test the new links.

Help authors have long relied on pop-up links, not only for defining terminology but also as a technique for layering information. Standard HTML doesn't support pop-ups, but HTML Help provides a few options from which to choose. The process of creating pop-ups is fairly involved; look under *pop-up topics*, *creating* in Workshop's Help index for more information.

POLISHING YOUR DESIGN

You've now created a usable system, but you may want to customize the HTML Help window. You can control the size and position of the viewer and the buttons appearing on its toolbar. Click *Add/Modify Window* and type a name for the window (anything will do), and then use the *Buttons* and *Position* tabs to define the window's appearance.

Large help systems can benefit from the addition of a fourth tab—*Favorites*—which lets users maintain a personalized list of favorite topics, much as they do in a Web browser (see Figure 5). In the *Window Types* dialog box, click the *Navigation* pane tab and select the *Favorites* check box. While you're at it, go ahead and select the *Advanced* check box in order to enable the advanced search interface. This provides expand-

few extra steps so they're dynamically merged when a user displays help. Workshop's documentation contains useful information on how to do this.

Testing and debugging come next. Proofing Workshop's error log is a start, but you'll also need to spend time manually testing your links and proofing your topics. Finally, you need to consider distribution issues. You can put your CHM file on a Web server for users to download, or you can install it on their local drives. If you're distributing help with a software application, you should include the HTML Help Installation and Update package (Hhupd.exe, found on your local drive in the HTML Help Workshop\Redist folder). This ensures that end users have the very latest HTML Help components.

Remember that Internet Explorer must be installed on your users' computers for them to view CHM files. For Web distribution, you may want to simply point users to the IE download page. Otherwise, you'll probably want to redistribute IE. The Internet Explorer Administration Kit provides a free distribution license (see www.microsoft.com/windows/ieak/en/default.asp). Version 5 supports a "silent installation" that doesn't add an icon to the user's desktop or alter the default browser, although early reports on using this feature have been mixed. Of course, once Windows 2000 ships

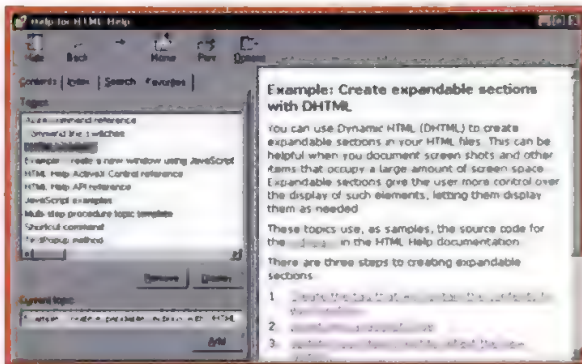


FIGURE 5: Adding a Favorites tab to HTML Help allows your users to bookmark topics.

HTML HELP AUTHORIZING

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If you want to start creating Microsoft HTML Help systems now, then take advantage of a unique offer from Blue Sky Software. They're giving away a free HTML Help authoring starter kit to developers, technical writers, documentation specialists and anyone else who wants to learn how to create HTML Help systems. Valued at \$249, the starter kit contains a free 15-day license of RoboHELP HTML Help Edition, an industry report on

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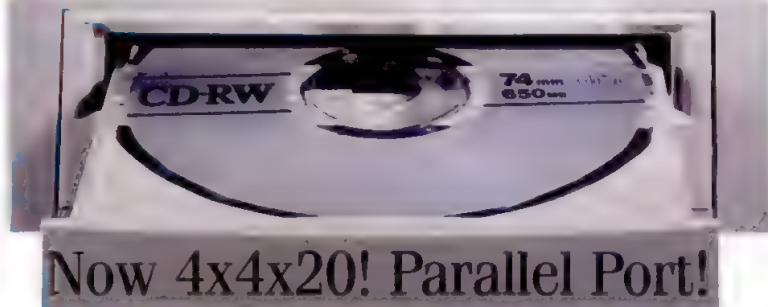
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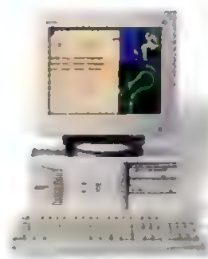
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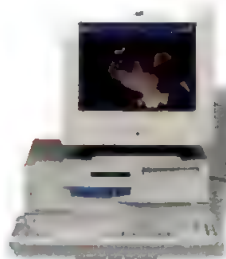
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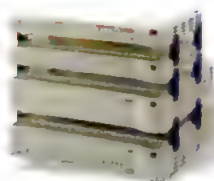


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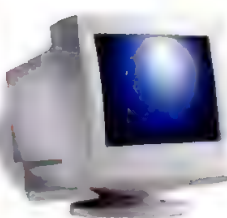


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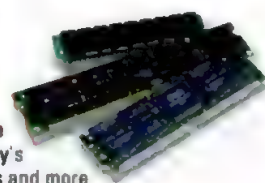
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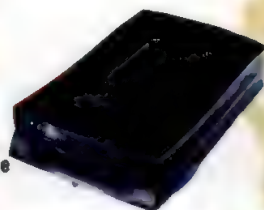


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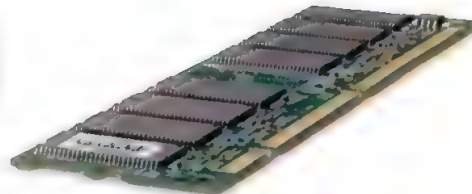
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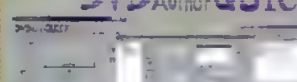


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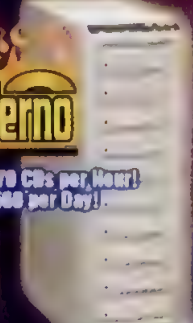


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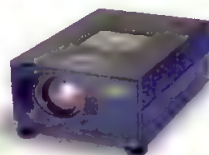
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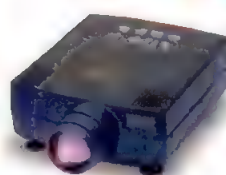
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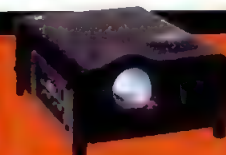
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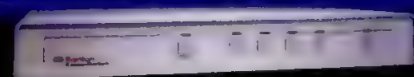


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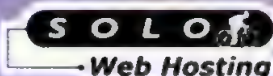
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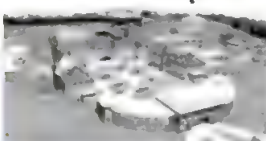
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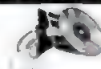
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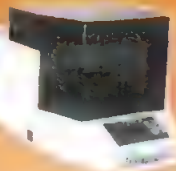
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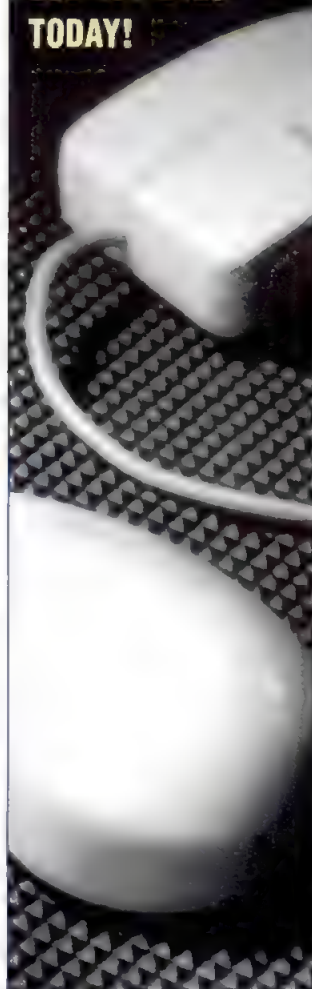
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FORCE-FEEDBACK WHEELS

Feel the Force

By Bruce Brown

Force-feedback game controllers are fun to use with a variety of PC games, including flight simulators, adventure games, and first-person shooters, but there's no category in which feeling the action adds to the experience more obviously than in racing games. This year one hand-held wheel and four standard controllers, which combine steering-wheel consoles and pedal trays, are ready to pump up the excitement of PC racing. With the current crop of force-feedback wheels, you get varied tactile sensations in response to road surface conditions, inertia, impacts, vehicle operation, and damage.

PC force-feedback controllers use Microsoft's DirectInput standard or Immersion's I-Force standard. We tested wheels from InterAct Accessories, Microsoft, and Saitek that use DirectInput technology and plug into the 15-pin game connector on your PC's sound card. We also tested a wheel from Logitech that uses the latest I-Force 2.0 standard and connects to a serial or USB port, making it the only wheel you can use with a PC that doesn't have a game port. In addition to a greater selection of force-feedback peripherals now available, there is also a much wider selection of game titles that support sensory response.

We tested the wheels, plus two

new gaming chairs (see the sidebar "Seat Sounds"), using a 400-MHz Pentium II Micron Millennium with 128MB of RAM and a Diamond Monster 3D II graphics accelerator. We tested the wheels with EA Sports' *Need for Speed: High Stakes*, Sierra Sports' *Viper Racing*, and the racing titles bundled with the wheels.

InterAct FX Racing Wheel

The InterAct FX Racing Wheel, the sole hand-held model we tested, is significantly less expensive (\$40 street) and much more portable than the full-size models. You don't get the same level of sensory effect with the small wheel that you do with a larger wheel that has separate pedals, but when paired with a good sound system, the FX Rac-

ing Wheel adds fun and realism to racing games.

The 13-ounce FX Racing Wheel measures 8 by 3.5 by 3 inches (HWD) and has an 8-foot cable. Two double-A batteries (not included) provide power. The controller tapers on one end; the most comfortable mode of use is to hold it like a pistol in your left hand while your right hand controls the 2.5-inch-diameter steering wheel. A two-way trigger controls your acceleration and braking, and you can assign the seven separate buttons to perform game functions.

There are no racing titles bundled with the FX Racing Wheel, but with the self-running installation software you can select from three levels of force-feedback intensity, test available effects including side-pull force and road-surface changes, and save 64 game profiles to configure button functions and special-effects selections.

The FX Racing Wheel comes fully assembled, so all you have to do is plug it in and load the software. In our testing, the hand-held FX Racing Wheel was immediately recognized, and it worked without failure.

The FX Rac-



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ing Wheel is sensitive and requires a light touch, but soon after connecting it, we were blasting down the road.—BB

InterAct V4 Force Feedback

The InterAct V4 Force Feedback is the value leader in this roundup. The bargain-priced racing-wheel-and-pedals setup provides impressive tactile feed-

port aids results in a very stable wheel console, but moving it isn't as convenient as moving the Microsoft wheel. You can also adjust the wheel's height and tilt angle. The pedal platform and AC power cords plug into the upper rear of the console. Once the pieces are set up, you plug the wheel's cable into your PC's 15-pin game port, install the software, and you're ready to roll.

You can quickly change wheel sensitivity, even in the middle of playing a game, but even at the lowest setting we



back and a host of programmable buttons and controls. It does not come bundled with any racing software titles, though. Like the Microsoft wheel, the InterAct model uses the DirectInput force-feedback standard, which aids game compatibility and component installation.

Two major pieces make up the V4 Force Feedback wheel. The console has a padded wheel with a 9.8-inch outside diameter and a total of 15 controls, several of which can be used for multiple settings. The controls include levers, thumb buttons, an eight-way thumb pad, and programmable buttons. The pedal base measures 8.8 by 11.5 inches. The brake and accelerator pedals are realistically close together and have a reasonable amount of nonadjustable resistance.

Installing the wheel takes about 15 minutes. You must attach four suction cups and two table clamps to the wheel before you can mount it on a table; this combination of sup-



experienced more road feel than with the Microsoft wheel at its highest level. The pedal platform didn't move around noticeably on the carpet, and the closeness of the pedals gave a realistic experience.

The lack of bundled game titles probably won't deter racing-software fans, who will enjoy the V4 Force Feedback's relatively easy setup, 64 game profile configurations, and realistic road feel.—BB

Logitech Wingman Formula Force

The Logitech Wingman Formula Force has four distinct features that set it apart from the other tested wheels: USB connectivity; I-Force 2.0, steel cable-driven force-feedback technology; a useful dead-pedal footrest; and a red steering wheel cover.

PHOTOGRAPH BY THOM OGDONOR

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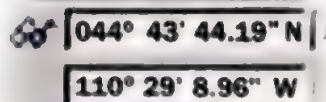
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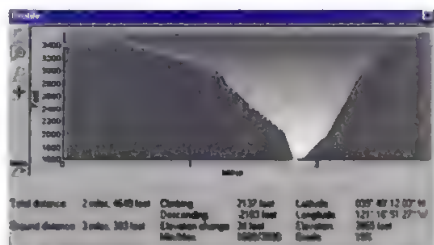
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The Logitech wheel has the same major components as the InterAct V4 Force Feedback, Microsoft SideWinder Force Feedback Wheel, and Saitek R4 Force Wheel. The console-mounted steering wheel measures 10 inches in diameter, feels realistically solid, and moves smoothly. The wheel has four spoke-mounted buttons and two paddle shifters. The pedal tray (the largest of the test group, at 12.5 by 14 inches) has a convenient dead pedal—a raised area on the left side of the tray on which to rest your left foot and hold the tray in place.

In addition to easy installation software and the Wingman Profiler, which lets you save game profiles and switch between game controllers, Logitech bundles full versions of Ubi Soft Entertainment's F1 Racing Simulator and Gremlin Interactive's Motorhead.

You don't need to assemble the Wingman Formula Force. Two adjustable clamps hold the wheel console firmly on a table

or desktop. The pedal tray, AC adapter, and USB cable all connect to the back of the wheel. For those who don't have a USB port, the Logitech wheel can connect to a 9-pin serial port, but USB's easy installation and hot switching are big pluses. As with the other force-feedback wheels, DirectX 5.0 or later is



required for tactile response, but this is the only wheel you can use with PCs that don't have game ports.

During game play, the Logitech wheel and pedals had a reasonable and realistic amount of resistance, and both the wheel console and pedal tray stayed in place. The Logitech Wingman Formula Force is a good choice because of its easy USB installation, stable pedal tray, and fine game response. —BB

Microsoft SideWinder Force Feedback Wheel

Fast setup, responsive controls, and a rugged feel characterize the Microsoft SideWinder Force Feedback Wheel. Constructed of black plastic, the SideWinder has two major components. The first is a console with a padded 10-inch-diameter wheel, a force-feedback toggle button, and eight control buttons. The second piece is an 11- by 13-inch platform with brake and accelerator pedals. The foot-pedal platform and AC adapter both plug into the back of the wheel con-

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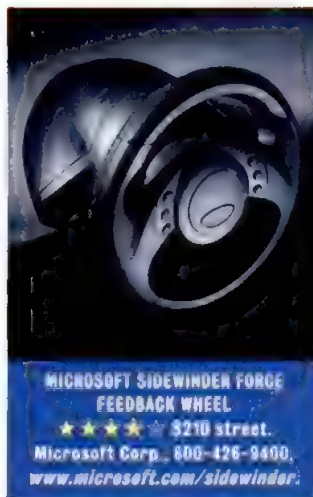
sole, which itself plugs into a 15-pin joystick port.

In addition to the driver software, bundled titles include Microsoft's *Monster Truck Madness 2* and *Precision Racing's Indy Car Simulator*, plus the *SideWinder Profile Activator* for creating game and user control preferences. You can set the *SideWinder* to detect game conditions such as icy roads, race car or diesel engine idle, tire blowouts, and potholes.

Installation is a strong point. The first step is to connect the power and foot-pedal platform cables to the back of the wheel console, after which you slide the console onto a tabletop, tighten an adjustment bolt, and

lock down a quick-release clamp. Note that the documentation would have you connect the cables after clamping down the console, at which point the ports are relatively inaccessible. No calibration was required on our Windows 98 test system. The parts and software installed within 15 minutes.

During game play using default settings, the *SideWinder* felt light, without much pedal resistance. But you can increase the resistance via the Windows Control Panel. The pedals also seemed a bit far apart when compared with the other products. The pedal platform moved a little bit, even on carpeting, but if you place your left foot on



the platform it doesn't move around too much—even with vigorous acceleration.

The high points of the Microsoft *SideWinder Force Feedback Wheel* are seamless installation and hassle-free game play.—BB

Saitek R4 Force Wheel

The Saitek R4 Force Wheel uses Microsoft's wheel mechanics, has more controller height and resistance adjustments than the *SideWinder* does, and includes the only realistic gearshift of the tested controllers. Unfortunately, the amount of assembly required and general flimsiness of the plastic components were significant turnoffs. The R4 installed without problems and functioned well during game

Seat Sounds

For higher levels of racing realism—even beyond excellent force-feedback wheels—new and improved accessories that enhance game audio can really round out your racing experience. When you augment fast, high-resolution graphics, tactile response, and the concentration required to play racing games competitively with immersive sound, the fun and excitement are even greater.

Force-feedback controllers deliver tactile response to game players' hands, but Imeron Immersive Technologies' gaming chairs develop the experience by adding audio and vibrations you sit on. Imeron, formerly BSG Labs, improved on last year's *Intensor Sensory Gaming Chair* with the new *Intensor LX 350* (\$180 street), which has better sound, a more conveniently located cable port, sound- and vibration-level controllers, and a much lower price. A new lightweight portable product, the *Intensor FX* (\$80), is intended specifically for game players who want to be able to move the unit to different locations. The *Intensor* products have built-in speakers and work by varying vibration with sound level; when you slide, skid, or bump into an obstacle while playing a racing game, the chairs vibrate in concert with the action.

The *Intensor LX* comes standard with a chair base but can also be used directly on the floor, without the base. The 20-pound plastic chair folds up into a turtle shape (without the base) and has a handle that makes it somewhat portable. A separate amplifier component plugs into AC power and connects to your audio card's speaker-out jack. The original *Intensor* (which cost \$400 with the chair base) had volume and vibration dials and a port for the audio cable (which came loose easily) inconveniently located in the front of the chair. The new *Intensor LX* uses a conventional 25-pin cable with screw-in connectors and has slide controls for

volume and vibration levels, all located on the right side of the chair. The *Intensor LX* has five built-in speakers, including a subwoofer in the chair back for added tactile experience. The original *Intensor* was impressive because it was a new concept in PC racing, but this year's model improves on the design and provides a more effective experience. The *Intensor LX's* speakers are loud enough that you won't need other speakers, and the vibration is strong

enough that you may actually flinch when you hit obstacles while playing games.

The *Intensor FX* is relatively small, measuring 4.5 by 18 by 14 inches, and the seat is light, at just 5 pounds. The *Intensor FX*, which does not have a back, has two internal full-range speakers and a passive magnetic actuator for vibration effect. Power and



audio cables plug into the left side, and the volume and vibration slide controls are on the right. Optional accessories coming later this year that plug into the seat include a vest that delivers tactile response and an adapter to work with the Nintendo RumblePak and Sony PlayStation. The *Intensor FX's* sound volume level and vibration effect aren't as strong as the *Intensor LX's*, but the lower price and ultraportability make it easy to add tactile audio response that you can take anywhere. (Imeron Immersive Technologies, Cary, NC; 800-274-5227, 919-467-4800; www.intensor.com.)—BB



More than 350,000 notebook computers were stolen last year alone. Too bad really, considering we make a security cable that's easier to use than most bike locks. As a matter of fact, almost every notebook made has a security slot designed specifically to fit our cable. For more info about our Notebook MicroSaver[®], check out www.kensingtonlock.com/pemg, or jump on your Schwinn[®] and head to your nearest computer reseller.

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AFTER HOURS

play, but it felt more like a toy than the heftier InterAct, Logitech, and Microsoft wheels.

Saitek's wheel ships unattached to the console. You need a small folding hex wrench, which stores in a hidden compartment in the back of the wheel, to attach the wheel and to adjust the brake and accelerator pedal resistance. Putting together the wheel was a minor annoyance made worse when one of the screws wouldn't seat properly. The hex wrench is made of plastic, and the tip quickly stripped, making it even harder to tighten and adjust the components. The 10-inch wheel has padded sides and adjustments for resistance and height. Two plastic buttons on the wheel and plastic paddles just behind the wheel worked fine in testing but felt flimsy.

After assembly, the R4 attaches to a table with a single

and the pedal tray stayed in place during long racing sessions.

The extra assembly required and light, plastic controller components detract from the Saitek R4 Force Wheel, which installs and functions acceptably and has more adjustment options than the other tested wheels in this story.—BB

Heavy Gear 2

Activision's Heavy Gear came to market full of bugs and design flaws, and so it was poorly received by the gaming public. Fortunately, Heavy Gear 2 is so impressive that folks might just forget about the ill-fated original.

Like MechWarrior 3, Heavy Gear 2 is a game of science-fiction combat, in which you control a giant, robotic war machine. Instead of a 30-foot robot, however, you pilot a much smaller machine known as a Gear. In fact, a Gear is a bit more like a giant suit of powered battle armor than a vehicle. Still, the resulting game play is very similar; you skulk around a series of battlefields,

find your enemies, and dispatch them with extreme prejudice.

Heavy Gear 2 features a single-player campaign of approximately 30 missions. One of the game's strengths is the fact that these missions are exceptionally well designed and varied. One minute you're clearing out an enemy base, the next you're trying to stay hidden as you tackle a covert operation behind enemy lines. You even get to do some zero-gravity work on space missions. Along the way, you have to lead up to four fellow Gears in squad-based missions.

Though the game is similar to MechWarrior 3, veteran



HEAVY GEAR 2
★★★★★ \$40 street.
Activision Inc., 310-255-2000,
www.activision.com.

game players will find Heavy Gear 2 most similar to Looking Glass Studios' underappreciated Terra Nova. The mission designs, the squad-level combat, and even the keyboard-centric Gear controls are highly reminiscent of that classic.

Heavy Gear 2's 3-D graphics engine is phenomenal. Well-modeled landscapes, highly detailed and animated Gears, and some truly spectacular lighting and weather effects all contribute to one of the best-looking games we've seen all year.

The game offers multiplayer support over TCP/IP LAN or Internet links. If not for the fact that Heavy Gear 2 doesn't let players adjust difficulty levels, we would have given it a perfect five-star rating.—Michael E. Ryan

MechWarrior 3

MechWarrior 3, from Hasbro Interactive, is the sequel to Activision's MechWarrior 2 and a worthy successor to that classic game of science-fiction combat. Though Heavy Gear 2 is the better game, MechWarrior 3 is very good in its own right, with exciting game play, great 3-D graphics, and a solid multiplayer component.

The game puts you in control of a 30-foot walking robot known as a BattleMech, or 'mech. Piloting your 'mech across a series of

wartorn landscapes, you must root out and destroy the forces of the rival 'mech army, Clan Smoke Jaguar. This conflict forms the backbone of the game's 20-mission single-player campaign, but you can also take part in customized "instant action" missions and multiplayer sessions over TCP/IP, IPX, modem, or direct serial link.

If you're a fan of 3-D-accelerated graphics, you'll find a lot to enjoy in MechWarrior 3. The environments are lushly detailed, and the 'mechs themselves are spectacularly animated—down to the paint schemes and every movable part. When you shoot at an enemy 'mech, your target will rock and stumble in accord with where you hit it and what type of weapon you used. You can even knock other 'mechs off their feet if you hit them with enough power.

The game play is similar to a tank combat simulation, except of course that you're cruising several stories higher than a tank ever would. Battles tend to be fast and furious, starting at long range but closing to in-your-face



MECHWARRIOR 3
★★★★★ \$40 street.
Hasbro Interactive Inc., 800-656-5443,
www.mechwarrior3.com.

duels very quickly. MechWarrior 3 is not an easy game, but it is addictive, and the difficulty level can be adjusted. Apart from a sometimes confusing interface, the game's only downside is that the single-player campaign ends too quickly.—MER PC



SAITEK R4 FORCE WHEEL
★★★★★ \$200 street. Saitek
Industries Ltd., 800-452-4377,
www.saitek.com.

clamp. The cable for the pedal tray, which has well-spaced brake and accelerator pedals, plugs into the back of the wheel console. Software installation was uneventful. The Saitek wheel comes with eight racing titles—all limited demo versions.

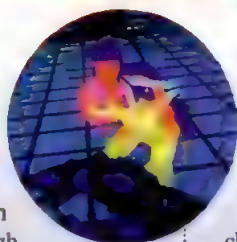
In game play, the Saitek felt much like the Microsoft SideWinder Force Feedback Wheel, as expected. The realistic shift lever is a bonus for those who don't like using paddle shifters. The wheel bucked, pulled, and vibrated acceptably,

Quick Clips

Aliens vs. Predator

 Aliens vs. Predator is a first-person action game with 32 tough and terrifying levels. You play one of three remarkably violent and combative characters: the alien from the Sigourney Weaver films, the predator that chased Arnold Schwarzenegger, or a basic human marine.

The game is similar to other 3-D action games such as Quake II, but it offers some unique twists—running along the ceiling as the alien, for example. This is a very challenging game, so we recommend you play it with the latest update (which adds the ability to save games midlevel). You will need a strong stomach for this one, however; it is one of the most graphically violent games we've seen in a while. \$49.99 list; Fox Interactive, 888-223-2369, www.foxinteractive.com.



Civilization: Call to Power

 Build a globe-spanning empire, democracy, or futuristic "ecotopia" in any time period, from the deep past to the next millennium, in this update to the classic strategy game Civilization. With novel new units and governments and a few altered game rules, Call to Power is a nice improvement over early versions. Occasional opaque game screens and a poor reference manual are its chief flaws. \$49.95 list; Activision Inc., 310-255-2000, www.activision.com.

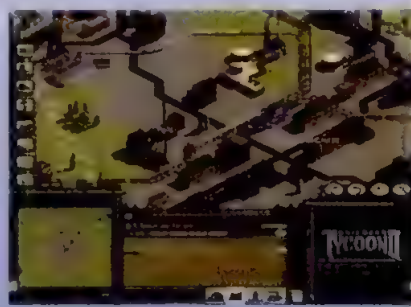
Man of War 2

 It may not be much to look at in this day of 3-D-accelerated computer games, but fans of TalonSoft's Age of Sail will find a lot to like in Man of War 2. You can walk the virtual quarterdeck of your own vessel as you take part in massive fleet actions or smaller, ship-to-ship duels. The interface is a bit awkward, and the game's appeal will likely drop off

significantly beyond fans of Patrick O'Brian and C.S. Forester novels. \$30 street; Strategy First Inc., 514-844-2433, www.strategyfirst.com.

Railroad Tycoon II: The Second Century

 This expansion pack provides a whole new level of playability for railheads who love Railroad Tycoon II. An ingenious new campaign includes wartime transport, light-rail scenarios, and speculative future technologies. \$29.99 list; Gathering of Developers, 877-463-4263, www.godgames.com.



Coming Up

What's in the Next Issue of *PC Magazine*

Your Personal Web

The Web as we know it is one-size-fits-all. But dozens of companies offer products to help customize content and online shopping, and they provide the kind of customer support you'd typically expect only from the corner store. We'll look at these new technologies, the sites that are experimenting with them, and how they will alter your online experience.

Searching Smarts

There's more information on the Web than ever, and new sites are popping up at a furious rate. Which search engine is best for finding what you need? We'll test the top sites to determine the engine you should use for whatever you're looking for.

Linux in Your Server Room

The buzz surrounding Linux as a low-cost Windows NT alternative is building. But is it right for your business? We'll investigate where Linux makes sense—and where it doesn't—and we'll test the latest Linux-equipped servers.

The Top 100 CD-ROMs

We'll share our picks for the best CD-ROMs of the year in every category.



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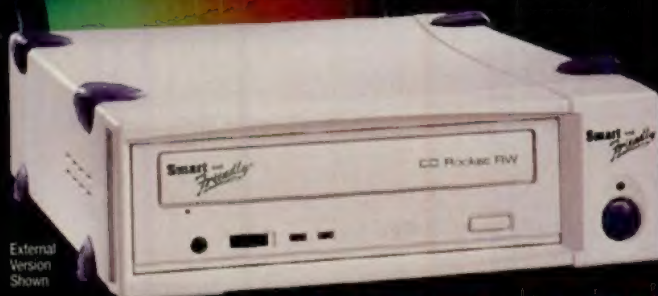


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